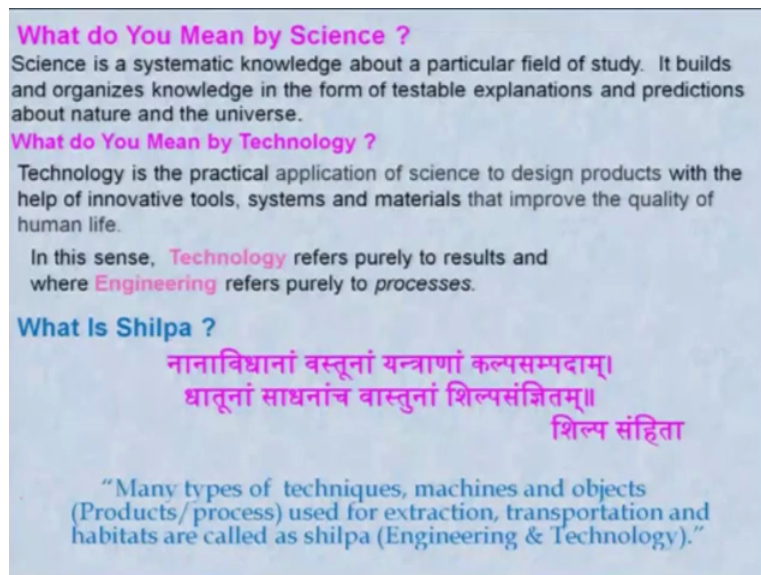


Introduction to Ancient Indian Technology
Professor D. P. Mishra
Department of Aerospace Engineering
Indian Institute of Technology
Module 1
Lecture No 01
An Introduction to Ancient Indian Technology

I welcome all of you to this course that is “An introduction to ancient Indian technology”. And most of you are aware that this country is having a very wider legacy of scientific heritage and where we have developed... we had developed technology. Unfortunately, it is not being taught in the class nowadays. And I was also not aware about this thing and five years back I came to know that we were having a large number of technologies and we our ancestors had developed quite a bit of science which will be helpful.

In this course, you will be learning about like a what are the philosophy of doing this this science and technology. And before that, like if you look at like you might be wondering why this we need to study this thing. Why we need to study the ancient Indian technology at this moment?

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What do You Mean by Science ?
Science is a systematic knowledge about a particular field of study. It builds and organizes knowledge in the form of testable explanations and predictions about nature and the universe.

What do You Mean by Technology ?
Technology is the practical application of science to design products with the help of innovative tools, systems and materials that improve the quality of human life.

In this sense, **Technology** refers purely to results and where **Engineering** refers purely to *processes*.

What is Shilpa ?
नानाविधानां वस्तूनां यन्त्राणां कल्पसम्पदाम्।
धातूनां साधनांच वास्तुनां शिल्पसंज्ञितम्॥
शिल्प संहिता

“Many types of techniques, machines and objects (Products/process) used for extraction, transportation and habitats are called as shilpa (Engineering & Technology).”

And before that, we need to ask certain questions like what do you mean by science, how it is useful. Can any of you tell me? What do you mean by science? Because science is being taught from the Class 1 onwards. What do you mean by that?

Student: Science is a study of any object or anything systematically and in a well organized manner.

Professor: Well organized manner. Any other answer?

Student: Science is something which defines how to live actually, how it is defined, how the way of living.

Professor: Way of living, we can call it as a science because it is basically we want to know the governing laws, what you know how the nature works, physical laws. And those things also had to be verifiable, right? That means as the other person told that it is a systematic study. And also it can be proved that it is right one, it is also subjected to scrutiny.

So therefore, we can say that science is a systematic knowledge about particular field of study or any field and it builds an organized knowledge in the form of testable explanation. There should be some logic, there should be why it is so, how it is so, right? And it must have some predictive tools. Suppose, you know certain laws or you know rules, then can you predict what is going to happen about the nature, about the universe? So that we call is generally science.

So science is basically as old as human civilization because man is basically a curious and creative creature by nature. So therefore it is his desire to know why it is happening, how it is happening, what can be done. Like that quest for the knowledge which is inherent in the human life or inherent with the human beings are basis of developing a science. So science is as I told is as old as civilization and so also the technology. But question arises what do you mean by the technology because all of us we are part and parcel of technology.

Technology is also is as old as civilization because earlier days what being told to us that people were living jungles and slowly and steadily they moved out of the jungles and settled down and developed the technology of harnessing the various what you call food and then shelter and then other things to have a life. So can you tell me what do you mean by technology?

Student: Technology is something that can support science. For example, if we...we have.....earlier times, we have parabolic mirrors to light up a....light up something, even a dry leaf, we use a parabolic mirror.

Professor: To concentrate the solar light you know light or the energy and then you ignite it, that is the point you are making, right?

Student: Yeah, right. Right.

Professor: Okay.

Student: So something which can support science is being defined by technology.

Professor: That means you can say the application of science by which you can develop a certain product or a process by which you can live a very what you call good life, right? So therefore we can say that technology is basically the practical application of science to design a product or a process with the help of innovative tools.

As I told earlier that man is a curious and creative creature, that means innovation is a part of human life. And it also the systems and when you talk about a product or kind of thing, you need to use materials. So therefore you will have to use tools, systems, and material that improve the quality of human life, because always the man is quest for the knowledge and try to use it to their advantages, to have a better life.

That does not mean that we will be leading a life only with the embroiled, with the materialism, right? We need to handle the material but material need not to be taking away the essence of life (())(06:26). That is what is happening nowadays. So therefore basically technology as I told is as old as civilization. Then question arises what is the (diff) you know difference between engineering and technology. Can anybody tell me? What do you mean by engineering? What are the differences between engineering and technology?

Student: Maybe themaybe there welfare of society is involved.

Professor: No, but then what is the....Is it engineering same as that of the technology?

Student: When technology is used in welfare of mankind and society, there....

Professor: No, that is always will be there. Any, any any knowledge as matter of fact is not only the science, not only the technology but also the philosophy, also the sociology, psychology. Any other form of knowledge is for the welfare of the human beings and also the environment where

they live. That should be the motto. But unfortunately we do not look at it that perspective. But that is the motto what our ancestor already always emphasize on that.

So engineering is basically a process of what you call doing. If you look at the engineering refers to the processes of doing. For example, like I know how to write and our ancestors were knowing also. I mean very earlier Vedic time or some other time you know like later on, that they were knowing how to write. For example, they can take a palm leaves and take a needle and go on writing, inscribing it.

But after that, the pen came. Then I, even when I was a kid, we used to use ink and dib the nip of the pen and then write. Later on, fountain pen came. Then the what you call ballpoint pen came, gel pen came. So these are all technology but the process, the engineering is that to have a pen, right? Or the process of writing.

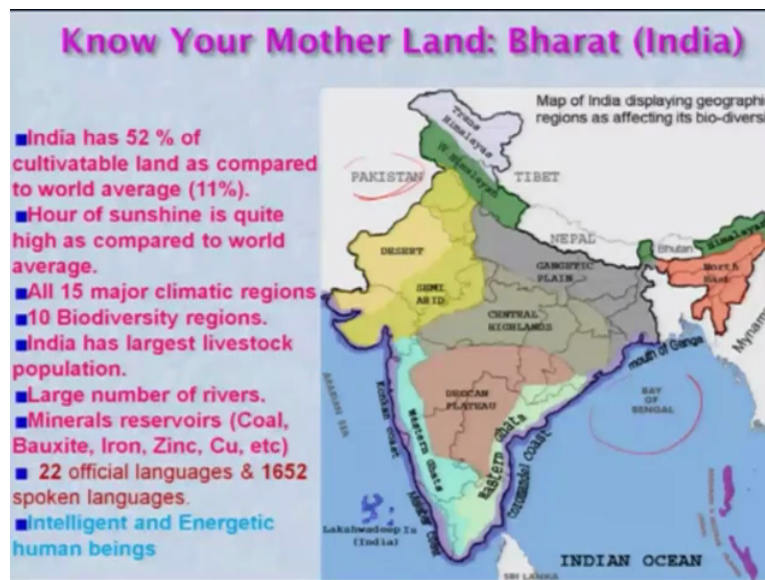
So therefore this is thing but let us....this is the way what we define. Let us see that what do you mean by Shilpa. We always talk about Shilpa. Shilpa, generally means in....is a Sanskrit word. But what we call is maybe some people translate into industry, right? When you talk about industry, like Shilpa kind of things, then we call it basically it will be involving technology, it will be involving engineering, right?

And it also definitely when you talk about engineering and technology, science always will be there. So let us see what our you know scripture says about that: "Nanavidhanam vastunam yantranam kalpasampadam. Dhatunam sadhanancha vaastunam shilpasangitam." The meaning that 'nanavidhanam', means various kinds of techniques, machines like a....and also the 'vastunam'. 'Yantranam' means machines. And vastunam means basically materials. It can be basically products, of course you can make product from the materials and the process.

And of course, when you talk about material, you need to know how to extractions, kind of things. And (sa) 'sadhanancha' means transportation, you need to move from one place to another and also the motion of the components one in a machine one can think of. And 'vaastunam' means habitats, you know like Vaastu Shastra we talk about, that is basically how to make a building or a hut or a room or a place or a fort. So that is together we call it basically Shilpa.

That means it is the combination of engineering and technology, that we call it as a Shilpa. Now when you talk about this science and technology, question now arises that why you will be talking about India. And earlier days, we call it as a Bharat. Bharat meaning basically which is always aspired to a better knowledge that is the meaning of Bharat you conceive.

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And we need to know what is the strength of this although lot of young people think that India is a very poor country and it is not doing well and we are having lot of problems or we do not have any strength. But no, India is having lot of strength, we need to relook at it. Therefore we are looking at Indian ancient technology in this course. And this is a very introductory course what we will be dealing with because there is a lot of things are there which cannot be covered in 30 lectures. Therefore I will be giving away a very (11:23) view of the technology which were being developed by our ancestors, which were having the proofs for that.

So if you look at this, I have shown here the map of India, in earlier days Bharat, nowadays in English we are calling it as India. So if you look at, this is the current map what we are having here. Of course, this portion is Pakistan, right? And earlier, it was a part of our country India before 1947. And there is also the portion of the Bangladesh, right? Kind of regions here and then before that who is a part of the Afghanistan which was there in ancient time as a part of our country. And beside this, like Bhutan other places were there and Tibet, those are the countries not with the India but earlier it was a part of India.

And if you look at that, you need to look at this map which is very important because of....there are several geographical things are there. And in this region, it is basically Bay of Bengal. We are having a very good coastal line. And here in this place, we are having Arabian Seas, this region, right? And we are having Kuchchh like Gujarat kind of things. And there is a desert area here which is a dry region.

And we are having Himalaya. Himalaya is a very important place because we are having a icecap there in the Himalaya and which makes the our country to be cool and maintain the temperature of this region. Trans-Himalayas, Western Himalayas, if you look at we are having Gangetic Plains, it is a very great fertile land we are having which produces you know lot of food grains.

And we are having semiarid region here in this region. And this is a Central Highlands where we are having... Lot of Vindhya hills are there. And then we are having also the as I told Eastern Ghat which is having mountain range that protects you know our country from the monsoon wind and so also the western region, it is instrumental for having good rains in this place.

And we are having Deccan Plateau regions and northeastern regions where we get lot of this thing and Himalayan region. If you look at, it is a very great country having a geographically reach in that. And if you look at, this iswe are fortunate now to have this country and we have taken bath here because this country is having 52 percent of cultivable land as compared to world average which is 11 percent. That means you know food is very important because as our scripture says, "Annapathishtadeva", so food is really very you know important for our life.

And we can get very easily in this place because of our country where cultivable land is quite a large bit. And beside this, for the food we need to have our hour of sunshines. The time period of the sunshines in a day in this country is quite high as compared to the world average. If you go to any other country, you know like it will be less, of course, Pakistan, Bangladesh, these are the our own part and then so also Afghanistan.

And we are having all 15 major climatic regions whatever the in the worldwide is there in this place. That is the you know (15:26) what we having in this country. And as I told that this is having a lot of climatic regions and very fertile land and lot of rains, water and other thing, therefore 10 biodiversity regions are available here. Therefore lot of people even today are

coming from outside country and living in jungles to look at our seeds, look at our biodiversity wealth and then do research and take those components and again recycle back to us with them; you know tax with a more money you know like we will have to pay for that.

That means these are the our resources. We are not aware. We should aware, we should do...we should take care of that. And beside this, India has a largest livestock populations. That means you know like cows, goats, the domestic animals, we do, it is from the time immemorial. We always a part of you know the animals which are helpful to us and also the other animals. We always believe that man is not only to live on this earth, man is one of them and all should live together. That is the ethos with which our ancestor had lived and that is there in our psychic even today.

So beside this, there are several rivers largely rivers like your Ganga and some portion of Brahmaputra also and Mahanadi, Kaveri, Jamuna. There are several rivers I mean are there which are endowed with that. And we are very fortune to have those rivers because they supply waters and then all those things. And beside this, mineral reservoirs are quite high like we are having coal storage and which can continue even if we use at this rate, maybe another 250 to 300 years of you know coal we can use that.

And we are having bauxite which is having large reservoir that is which we produce aluminum, so also iron, zinc and copper and several other minerals, we are endowed with them. So these are the wealth we should utilize. Not only that, India is having 25 official languages and which is having 1,652 spoken languages which are being developed.

And most of the languages are scientific in nature and it develops, it you know it help. It...those are if are learned properly, it can help you to develop a good mind. Unfortunately, it is not being you know taken seriously and learning properly this language and which must be what you call retained much, must be protected from the onslaught of English which is a dominating on the other language today.

And beside this, we are having the very large populations and people are here invariably intelligent and energetic in nature. And that is why they are also corrupted according to my interpretation, right? So therefore and they are not doing well for the development of our nation because they are not being educated properly. And education should be done properly such that

they can channelize their intelligence and the energy for the welfare of the country and also they can grow.

So it is because of bad education, because of what you call unsupportive government and social systems by which they are being affected, they are not contributing. But I am sure if they are educated properly and under the better leadership, and social environment will improve and we can have a very good, nice place to live that is in this country.

So it is having a very good what you call (can) capabilities and it must be harnessed properly and directed properly so that we can really do. So therefore it is important to look at our heritage and culture. And let us look at what is a difference between basically I want to give like ancient and present India geographically.

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If you look at, India is having something 29, sorry, 29 states and 7 union territories. Unfortunately, some of the states are being bifurcated in the process of bifurcation. So it maybe more states to come. And this is the map which I have shown. I mean I need not to go through all the states. And but earlier days, as I told earlier that it is...

I have taken the Mauryan dynasty and which was something 265 BC. It is having territory not only the India larger portion, except this southern portion and then eastern, northeastern portion.

Like it was having also the Pakistan and some portion of Afghanistan here somewhere, right? So it is having a very last territory.

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Chronology of Major Periods and Dynasty	
Period	Event
25000 & before	Prehistoric Period
3000 -1500 BC	Indus–Sarasvati Valley Civilization (Sind, Pujab, Gujrat, Haryana)
1500-500 BC	Protohistoric Vedic Period (Punjab, Gangetic plane, Kashmir)
563-334BC	Historic Period (Gautam Budha, Bimbisara, Ajatasatru, Mahapadma Nanda of Magadha, Invasion of Alexander)
322-232BC	Maury Dynasty (Chankya, Chandragupta, Binndusara, Asoka)
190-71BC	Sunga Dynasty (Saka's invasion)
320-647AD	Gupta Dynasty (Chandra Gupta I, Samudra Gupta I, Chandra Gupta II, Kumar Gupta I, Huna Invasion, Skanda Gupta I, etc)
712-1192AD	Northern Indian Dynasties: (Yasovarman, Pratiharas of Kanyakubja, Palas, Senas of Bengal, Calukya of Gujrat, Kesari of Kalinga)
300-1565AD	Southern Indian Dynasties: (300-888) Pallvas, Kanchi, (757-973) Rastrakuta (W&C Deccan), (850-1276) Cholas, (1197-1323) Kakatiyas of Warangle; (1138-1300) Ganga Dynasty (1300-1500) Gajapati Dynsty (1336-1565) Vijayanagar empire.
Indus Valley Civilization is 8000 years old: IIT Kharagpur 'Nature' journal, 25 th May 2016 (Bharrana, Haryana)	

And if you look at the chronology of major periods and dynasty, let us go through it because it may be helpful for us to get into the technology, how it is developed and where it was developed, kind of things. And if you look at 25,000 years and you know before, that is known as prehistoric period. And of course, 3000 to 1500 BC we call Indus Valley Civilization and nowadays we are calling it Indus-Sarasvati Valley Civilization because Sarasvati river was there, I will be showing you picture. And the major areas if you look at, it comes under that, basically Sindh, Punjab, Gujarat and Haryana kind of thing.

And although I have taken this 3000 to 1500 BC the period, but generally we believe it is 5000 BC, right? In our mind, it is there. And recently, IIT (Kadak) Kharagpur, they have done research. They have published this work in the 'Nature' which is a very prestigious journal in 25th May, 2016. And they have excavated the data, you know the Bharrana region in Haryana. And they are claiming that Indus Valley Civilization not 3000 years back BC, it is basically 8000 years kind of things back, right?

So it is what you call older than the Mesopotamia and that is the claim I wish that it should be right one. And that is the thing what is there our mind and it is there in our scripture also, it is

trying to prove. So therefore it is very important that we should do the research and carry it out. And the objective, the motivation for me to take this course is to encourage you people to do the research on the Indology, ancient technology and other thing so that we can find out the truth what it is.

And then 1500 to 500 BC, that is the proto-historic Vedic period what people are saying, I have taken the data that which is being accepted worldwide. And that is a region is Punjab, Gangetic Plain, and Kashmir region where the Vedic period but however our scripture say that Veda is around something 5000 years old minimum, that is the thing, (23:29) quite old.

So therefore more research is you know required to find out the exact date where we are having the Vedic period. Of course, that has been accepted by worldwide what I have quoted here. And 563-334 BC is a historic period where the lot of people took bath and they have contributed. I have just mentioned that about Gautama Buddha, Bimbisara, Ajatasatru, these are the king. You might be aware of Gautama Buddha who was a profound of the Buddhism and which has crossed, which has spread.... which was spread over the entire you know larger portion of Asia and other regions also.

Ajatasatru and Mahapadma Nanda of Magadha and during that time, there was a invasion of Alexander which was being ...this invasion was being nullified. And by....at that time the King Porus and he was forced to go and have a troops with the the Porus the king in the frontier regions of India. And during that time, there was a stalwart who came up whose name is Chankya. His name, also other name is Vishnugupta. He was instrumental of installing the Chandragupta as the king of Magadha and which have done a wonderful work. He has written also Arthashastra which is something 330 BC to 232 BC onwards.

Of course, after that Binndusara and Asoka came. And there is a Sunga dynasty, 190 to 71 BC. During that, Saka invasion was there but it was repulsed. And 320 to 647, there is the Gupta dynasty which is the golden era of our history what people talk about. There are several kings came up and they did a wonderful work like Chandra Gupta I, Samudra Gupta, Chandra Gupta II, Kumar Gupta. And during that time, there was a Huna which invaded our country.

And also that was being repulsed back and of course the other kings is Skanda Gupta. Later on, of course 1712 to 1192, in northern India, several dynasty; there is no single dynasty as such:

Yasovarman, Pratiharas of Kanyakubja, Palas and Senas of Bengal and Chalukya of Gujarat, Kesari of Kalinga and other things.

And 300 to 1565 AD, in the Southern Indian dynasty, there are several kings: The dynasties like Pallavas, Kanchis; of Rastrakuta's like in western and central Deccan region; 850 to 1276, Cholas and 1197 to 1323 AD is Kakatiyas of Warangal, we will be discussing something about their you know technologies. And Ganga dynasty, we will be talking about certain technology of their; 1300 to 1500, Gajapati dynasty in in Orissa. And Vijayanagar empire was a very important in the southern side that is 1336 to 1565. So I will stop over here.

Let us now look at what we have learnt. That, we have looked at what is the science, what is the meaning of technology, how it was defined in basically technology and the engineering in our ancient time and what is the importance like of this country, what are the wealth we are having, what are the positive things we are having, and then we look at like chronologically how it is the various periods and dynasty in our history. In the next lecture, we will be discussing about basically how to why we need to look at ancient science and technology. Thank you very much.