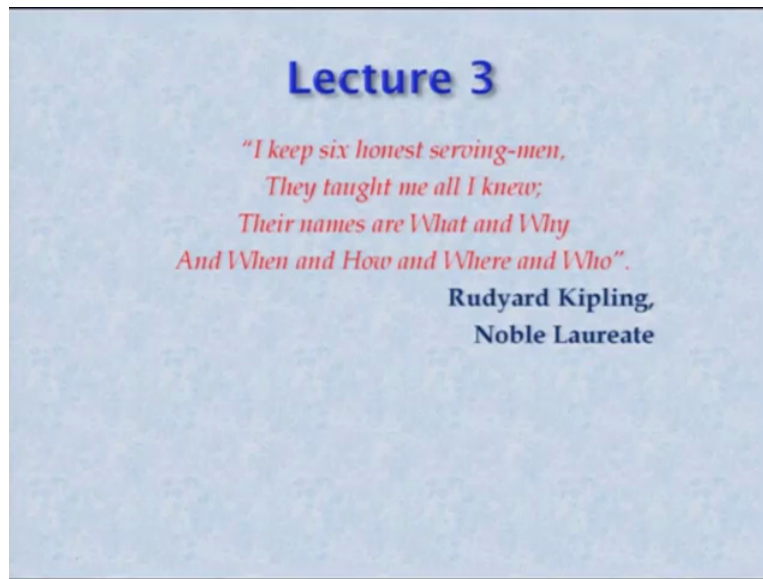


**Introduction to Ancient Indian Technology**  
**Professor D. P. Mishra**  
**Department of Aerospace Engineering**  
**Indian Institute of Technology**  
**Module 1**  
**Lecture No 03**

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Let us start this lecture with a thought process from Rudyard Kipling who is well known Nobel laureate. He states, "I keep six honest serving-men, they taught me all I knew; their names are What, Why, When, How, Where and Who." These are the very important tools for gaining the knowledge. Rather, in other words, converting the information into knowledge can be done by these questions. So let us now recall what we learnt in the last lecture.

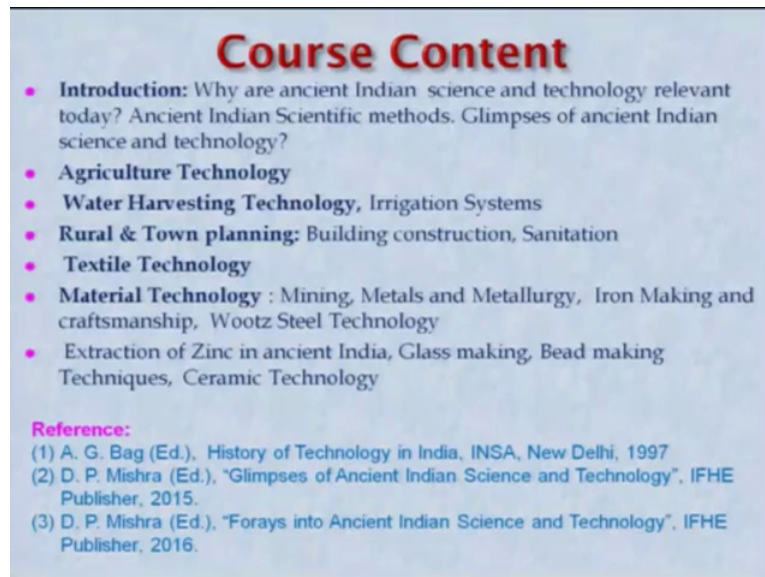
We basically started looking at the meaning of the civilization. Because we had started discussing about Indus Valley Civilization, so we need to know what is civilization. If you look at the civilization is basically a human society which has developed in such a way that it will be having a sufficient amount of food and higher level of spirituality, science, technology and also the rural and urban areas in a some group they will be developed. And it will be having also a philosophy and unique cultural values what they live.

And we also identified the characteristics of a civilization and we also looked at what are the contribution of Indus Valley Civilization to the world. And what we call today the Indus Valley

Civilization as Indus-Sarasvati Civilization. And it is having enormous and then we have also looked at the comments made by the giants like Aurobindo and Swami Vivekananda. And also similar comments on the this Indian civilization were made by several other western scholars and they felt that India's civilization was quite rich.

And even today it is also living. I must tell you that that Indian civilization is still alive but whereas the most of the ancient civilization are almost dead. So we need to relook at it and today we will be looking at basically that why we need to look at the ancient Indian science and technology.

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**Course Content**

- **Introduction:** Why are ancient Indian science and technology relevant today? Ancient Indian Scientific methods. Glimpses of ancient Indian science and technology?
- **Agriculture Technology**
- **Water Harvesting Technology,** Irrigation Systems
- **Rural & Town planning:** Building construction, Sanitation
- **Textile Technology**
- **Material Technology :** Mining, Metals and Metallurgy, Iron Making and craftsmanship, Wootz Steel Technology
- Extraction of Zinc in ancient India, Glass making, Bead making Techniques, Ceramic Technology

**Reference:**

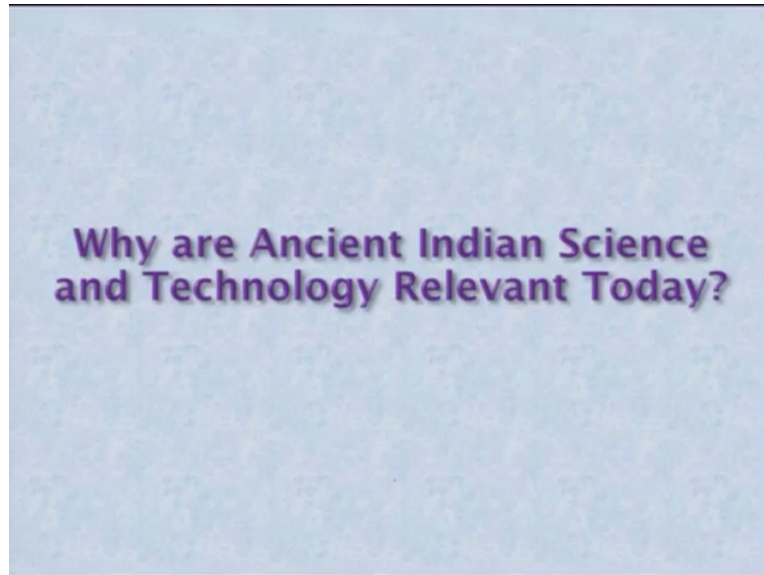
- (1) A. G. Bag (Ed.), History of Technology in India, INSA, New Delhi, 1997
- (2) D. P. Mishra (Ed.), "Glimpses of Ancient Indian Science and Technology", IFHE Publisher, 2015.
- (3) D. P. Mishra (Ed.), "Forays into Ancient Indian Science and Technology", IFHE Publisher, 2016.

And before that let me just tell you that we have also covered the course content, I need not to go through it. But I would like to draw your attention that you can (for) you know refer these books like a History of Technology in India and from which I will be taking most of the material for this course and which is edited by A. G. Bag. And it is basically published by INSA that is Indian National Science Academy which is a well known organization in New Delhi.

Beside this, recently we have published two books: One is Glimpses of Ancient Indian Science and Technology in 2015, you can refer that; so also the another book this, Forays into Ancient Indian Science and Technology, again edited by myself. So you can get this book. These are very small book. You can call it as a book, let not a book.

You can get in Amazon.com, as kind of things, you can go through this. And some of the material I will be taking from all these three references. Beside this, lot more places I will be using.

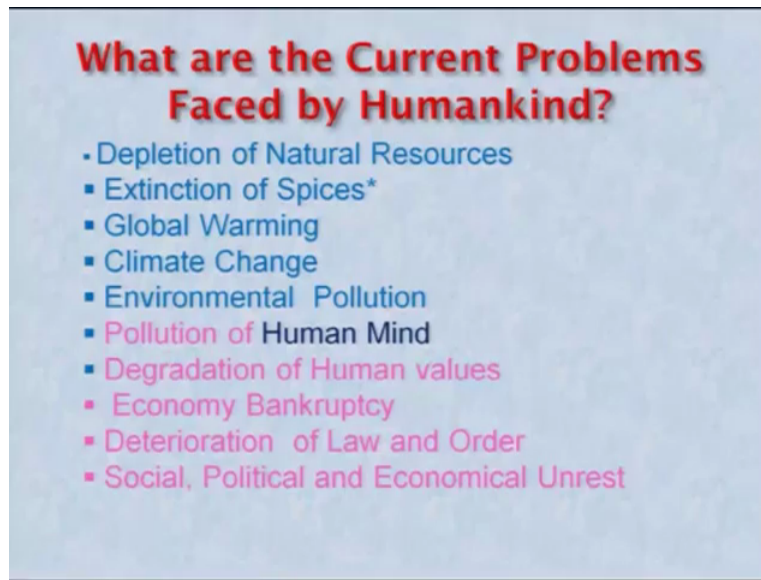
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So now we need to ask this question: Why are ancient Indian science and technology relevant today? Because you know you might be thinking that we are at the pinnacle of the scientific and technological development. And when we are at the this thing, why we need to look at ancient that to Indians, Indian science and technology? Lot of people like you who are not exposed to the Indian science and technology, they might be thinking we are not having anything.

So if that is the assumption you are having in your mind, the natural question is, why we need to look at it? So before really answering these questions, we need to ask also few question. Let us ask this question:

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What are the current problems faced by humankind? Can anybody tell? Like...?

Student: (05:23)

Professor: Not the same thing, maybe different if it is coming to your mind.

Student: (05:29) difference.

Professor: Okay, fine. So what we are discussing is basically depletion of natural resources. As I was telling earlier that petroleum you know is the engine of the modern life and it is depleting at a faster rate. Not only petroleum, but other things as well like your iron ore or your any other resources, natural resources you are having. For example, jungles, mountains.

We have already destroyed the Eastern Ghat and Western Ghat which is a protective for us as I told in the last lecture. And extinction of species, there are several species particularly in this this country, India where there was a biodiversity. And the number of species were quite high but it is receding at an alarming rate.

Toh, if you look at as to the review published in May 29, 2014 in a very prestigious journal of science, current extinction rate happening is around something thousand time faster due to the human beings. You see we are supposed to be the protector of the environment and so also the

living beings, we are destroying it. And almost around 20,000 species are near extinction. They may you know will not be there.

And in the name of development, we are doing it. And why we are doing this? How we could do this? Because of the power we have got due to the modern technology. So also the global warming and we all of know that we are being affected by the global warming, temperature is going up. You might be knowing like yesterday it was quite hot in Kanpur in November 23rd and today it has...it is changed, it is little relatively cool, right?

So there is a change in the...kind of climate change across the globe. And the climate today you can predict. There might be cold, there might be quite hot and then rain may come in, you know it is unpredictable. Climate is changing and so also environmental pollution. The environmental pollution is a epidemic stage. Now the....we need to look at it. It is not only the air pollution which is being created by what you call use of fossil fuels for our transport and power plants and other things.

And there is water is being polluted which is a very important for the sustenance of any form of life not only human being but any form of life. And not only that but also the pollution of human mind. Today mind is not at peace; all the time, it is agitated. And also it is causing a lot of turmoil in the mind of the people. As a result, there is a degradation of human values. Like I always feel that India is having 130 crore people but where are the human beings? They do not have the qualities of human beings. The certain qualities are required which will distinguish a them basically from the animal.

So and there is a problem and an economy bankruptcy. There is a total if you look at the economy of the entire globe not only India is on basically gambling, that is 'sayer' you know business. And there is no what you call constancy in that. So therefore we are in deep trouble. And deterioration of law and order not only in India, across the globe.

And there is a unrest of social, political and economical. Always the you know like unemployment, there is a lot of problems around that. So if you look at, these are the problems we are facing, we are facing as of now. Now what are the solution? What are the solution for this? And what are the causes? Because if you want to find out solution, we need to find out what are the causes right of that.

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Let us look at that what are the effects of global warming. There is a rise of sea levels. You know, in recently in Orissa, lot of land being lost near the what you call sewage in Puri where the Lord Jagannath temple is there. And so also in West Bengal and the coastal area, lot of problems, land is being consumed by the sea, right?

You might be aware the Sundarban areas, we have lost a lot of land and which is submerged in the sea. So that is a big problems we are...we will be facing in future because the what you call the ice being getting ....melting out. So those will be....as a result, there will be sea rise. And we, I already talked about the habitat damage and species being you know extinct. And their life is also very important for to have a balance with the human being you know in this beautiful earth.

So there is a increase in temperature. There is no doubt about it because I remember that when I was a kid, I used to live without a fan; today in the same place, I cannot live without air conditioner. So therefore the temperature is rising at a very faster rate and it is causing a lot of other problems also. And water quality and also the quantity are in deep trouble. You might be knowing in Kanpur the water level is going down per year around 0.5 to 0.7 meter, right? Going down water level, ground water level.

And it is not only that like in....it is also worst in some other places. Being in a Gangetic Plain nearby Ganga, we are better-off but in other places, it is in deep trouble. And so also the quality of the water. And this because of we are doing.

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**Warm Winter in Himalayan Region**

The threats to biodiversity arising from climate change are very acute in the Eastern Himalayas (EH) as the region is rich in threatened and endemic species with restricted distributions.

The region's wetlands are being affected by the erratic weather observed in many parts of the region. This affects will affect **Water quantity and quality** in rivers like Ganges and Brahmaputra.

**International Centre for Integrated Mountain Development (ICIMOD)**

Let me talk about warm winter in Himalayan region. Himalaya is a great thing for us because it is having a very big icecap. And that lowers the temperature and maintains, balance the temperature in this region. And the threats to the (biodiver) biodiversity arising from the climate change are very acute in eastern Himalayan regions and that region is threatened.

And there is a endemic species with the restricted distribution because the species are getting extinct. Not only that, you might have watched in a TV like you know people are going and for trekking and it has become business. Lot of people are going and they are putting, dumping all the plastics and other things and spoiling the environment.

I always tell to my student who are (trek) going for trekking from IIT Kanpur, “You please do not go. And if you are going, make sure that you take all those out and clean that Himalaya because that is the big thing for us.” Not only Himalaya, for any other mountains are very important for our life because they control lot of things without our knowledge. So we should not spoil them and kind of things.

The for example, we are having technology, therefore we could manage to go to that place, otherwise no, right? Very few people could go. So therefore technology may be helpful but it is also spoiling the nature. And so the regions, these regions specifically, Himalayan regions wetlands are being affected by erratic weather observed in many parts of the region. And these, we are having not only the wetlands in the Himalayan region, other places that control the environment. So those are being spoiled.

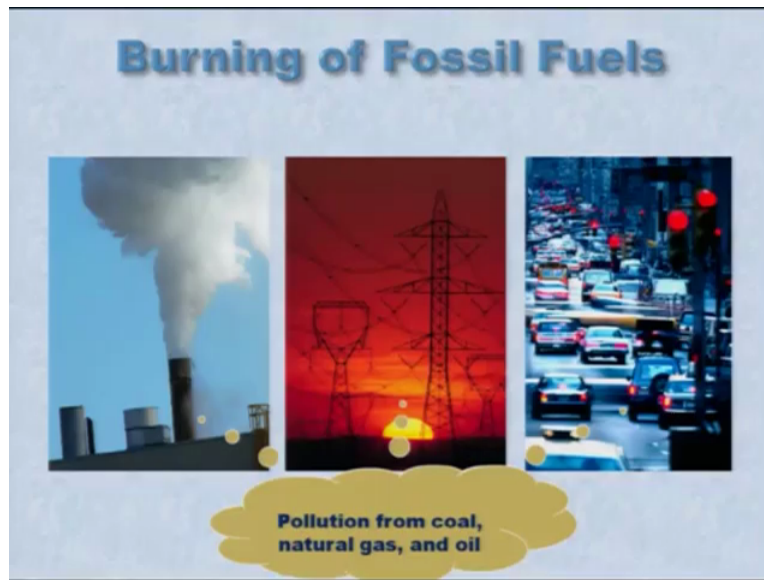
And these effects will....basically these things will affect the water quantity and quality in rivers like like Ganga or Brahmaputra kind of things. So because this is being fed from the Himalaya, and not only that wetlands we know talking about basically it is not only in the Himalaya, other places also. It is almost people have swallowed the wetlands and they have taken for their habitats and other thing.

And those are the points we need to protect. They should be actually, according to me, Himalaya should be no man's land, no (shou) nobody should go there. It should be protected then only....because then only it can really preserve the originality and we can have that.

So what is important is that in this country we are endowed with natural resources and they are the players who maintain the balance in the ecology and we need to protect them. And like in a ancient time, we are we are having rules and regulation. If you go to the Arthashastra and other thing that you will find there is a reserved regions which where people will not enter.

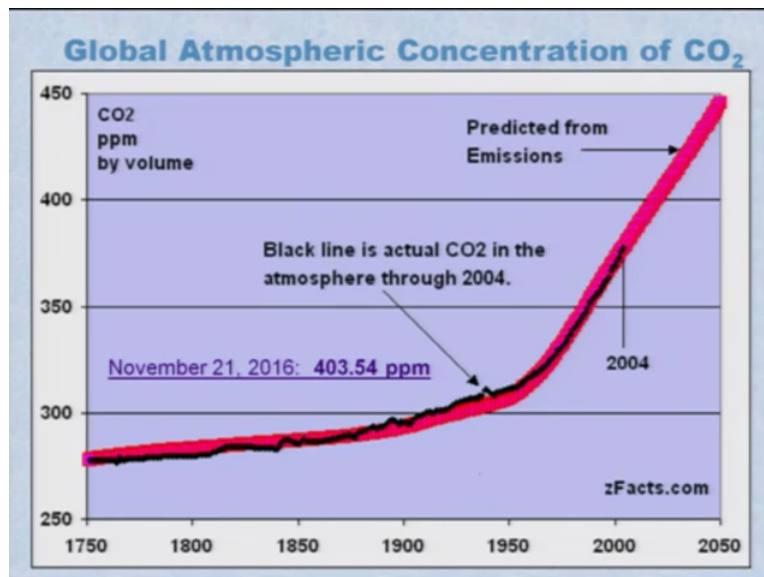


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So we know that burning of fossil fuels is causing a lot of (pop) pollutions you know in our city and also the other areas where the power plant being installed. We know we are having Panki Power Station in Kanpur, how much a dust level, how much you know carbon dioxide and other thing we emit. And then we...that creates a lot of problems in you know and in around these places.

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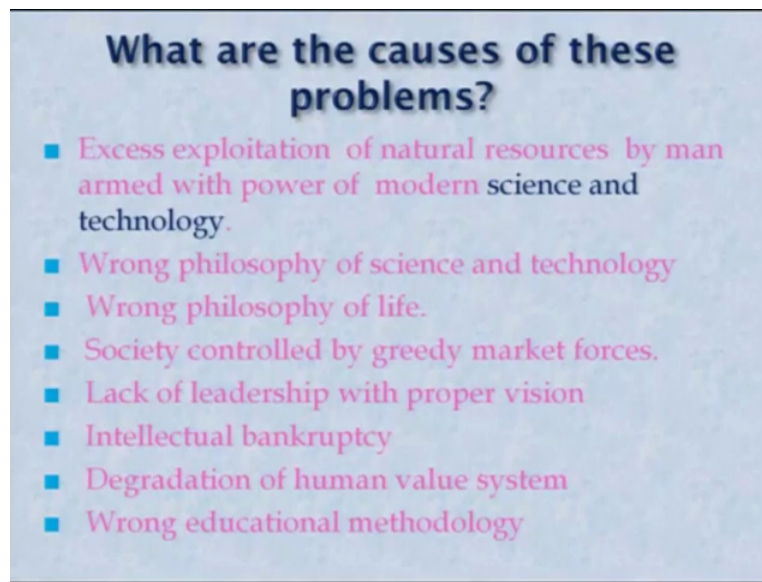
So if you look at, as a result this there is a increase in the concentration of carbon dioxide. You know that carbon dioxide is basically a greenhouse gas which is increasing. If you look at, these are the points that these are the experimental points. And this pink color is the prediction. It is going you know ...it was basically it it was increasing at a very smaller rate for 1750 to 1950, because you know 1750 is taken as a (0)(16:24) that was a industrial revolution what started in western countries.

And then it is increasing 1950 or maybe around that increase at a very faster rate and today if you look at, it has crossed the 400 marks. If you look at the data, November 21st 2016, this is 403.54 ppm and it is quite high. And if it will go above let us say 450 maybe another 30-40 years or 50 years, we will be in deep trouble because you know like it will be causing a lot of problem in this hall, there might be lot of you know death and then there is a imbalance and it will go somewhere we do not know.

So therefore one has to be very careful about that. And and all these thing we are doing because of the problem...because of the power we have got from the modern technology and the science and we are misusing it, abusing it. So if you look at, what are the causes of this problem? This problem is basically as I told excess exploitation of natural resources by man armed with the power of modern science and technology. Is it this? This is the only cause or is there any other cause? Can anybody tell me? What are the other causes?

This is one cause we know like because if the technology could have not there or if the man could have not you know having the power to understand the physical laws and the nature, they could have not done that. But is it the only cause for these problems what are facing or is there any other causes? Any idea?

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So if you look at, it is not that the science or technology are responsible. It is the philosophy of the science and technology that is very important, is the cause. Why? Because if you look at, we believe that we are a part of Mother Nature but the modern scientist like Baker or Darius who are the profunder, they started talking about that they want to win over the nature armed with the science and technology. How can it possible? Because we are a part of the nature.

So if if (suppo) for example, I am a part of it, my hand is a part of it, can my hand win over my (bo) entire body? Certainly no, it is foolishness. So therefore the philosophy of that they want to win over the nature is wrong. Similarly, how can I when I am a subset of the whole set will be winning over swallowing it? No, not possible. And if you do that, you will be facing the similar problems.

So wrong philosophy of life what for we are and whether we you know like we are being consuming the product and process you know kind of things and living a life like a animal running from pillar to post from the morning to night, even we will not sleep in the night you know for doing work, so then we do not know what is the objective of life, what is the philosophy of human life.

Human life is very important because human is unique animal in the entire what you call animal systems and the...or living beings. Society today controlled by the greedy market forces. Today

our life is being controlled by them. What kind of shirt I will wear, what kind of shoes I will wear, what food I will take, what are the things, we get swayed by them.

As a result, we also the they they control our health, right? So health and they want to grab our wealth. So therefore we are in deep trouble. And we do not have our own thinking, they are making us busy from morning till the late night so that you do not have time to think and you become seized to be a human being. Unless you think yourself what you are doing, you are not a human being because man is a thinking animal by nature.

So therefore we seize to be and we are being made ourselves busy for getting them to be satisfied their greedy nature. So lack of leadership with proper vision, who will tell? The leaders today are not leader. They are managers. There is a difference between manager and leaders. So leader should have a vision not that micromanage and what is to be done, what not to be done. So therefore we are lacking in leadership not only in country like India but across the globe.

And there is a intellectual bankruptcy. People are not thinking. If they are not thinking, they do not have ideas, they will just followers, they are not idea generators. Rather in other words, they are not creative in nature. As I told earlier, man is a creative creature by nature. Unless he will be creative, he cannot enjoy the life. So therefore he cannot come up.

So degradation of human value system: And when you are become a human human being, then value come into picture. Animal will not be having value, right? So therefore that we are not living a proper human life or humanity is at stake, therefore we cannot have a good value system. So wrong educational methodology: The way we are being educated, the way we the way we are being taught is not right way of doing. So therefore whole problems are tantamounts to that.

So and on the top of it, lack of spirituality. Spirituality is a natural state and which we have forgotten in the name of development, in the name of modernity. So therefore these are the very important causes of the problems. So therefore if you look at, these are the causes of problem then what are the solution? And we are now trying to answer the question, why we need to look at ancient science and technology and how to go about it?

And I have already identified the problems; we need to find out solution. So we will stop over here and we look at in the next lecture. Thank you very much.

