Sociology of Science

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Lecture - 03
History of Science: Thomas Kuhn

Dear students, and the first 2 lectures we discussed, what is sociology, what is sociological perspective, how to connect individual experiences with a broader social context, the intended unintended consequences of social action, the idea was to give you a brief understanding of what is sociology. Now I move on to the course which is science technology and society. Today I shall discuss different historiographic traditions in history of science. History of science is a specialized branch, a sub branch of science as well as sociology; where the scientists or the historians of science, they look at the development evolution of scientific structure, scientific developments, scientific thought process in a historical context.

This discussion is mainly drawn from Thomas Kuhns contribution to encyclopaedia of social sciences which came out in 1968. And there, he wrote a piece called the history of science, and in the article on history of science Thomas Kuhn has essentially traced different origin of history of science the factors of change of historiographic tradition within science. The internal history, and the external history of science. The 2 important thought processes, which have stimulated the interest of scientists themselves as well as historians of science; that is, merton thesis. And within that, how merton has discussed the influence of Francis bacon as well as the puritanism as a major stimulant for scientific development.

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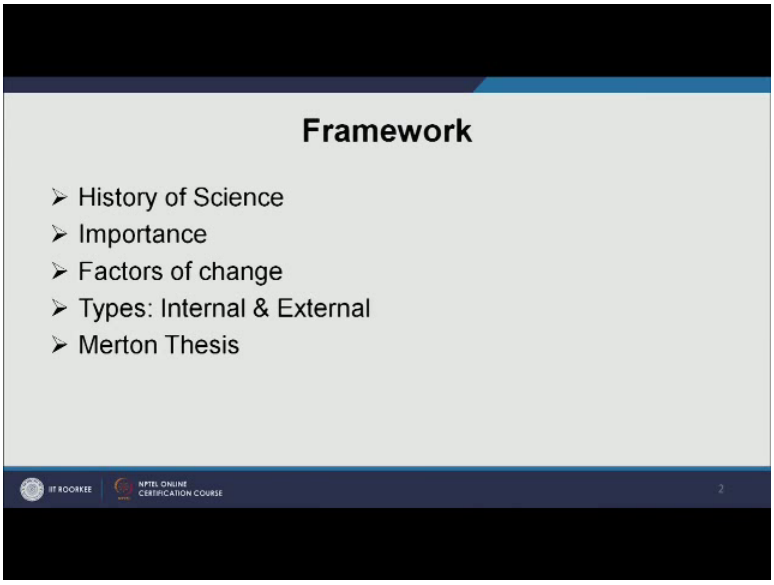

This is roughly, the framework. We will just discuss the history of science, how important it is, the factors of change 3 historiographic traditions, then internal history and that external history of a science. Then look at the merton thesis in support of it and a critique of it. Now essentially, the history of science is a special subject as a sub branch is of recent origin. By recent origin we mean, it is a product of 1950's. And mostly the historians of science were found in 1950's united states of America. So, it has a new origin and most of the practitioners or the professionals, who did practiced history of science were from the US. Now Thomas Kuhn says that 2 historiographic traditions, which is of note which needs to be mentioned; when we discuss the subject history of science. First, is the only 9100 early 19th century narratives which are written by practicing scientists on their specialities.

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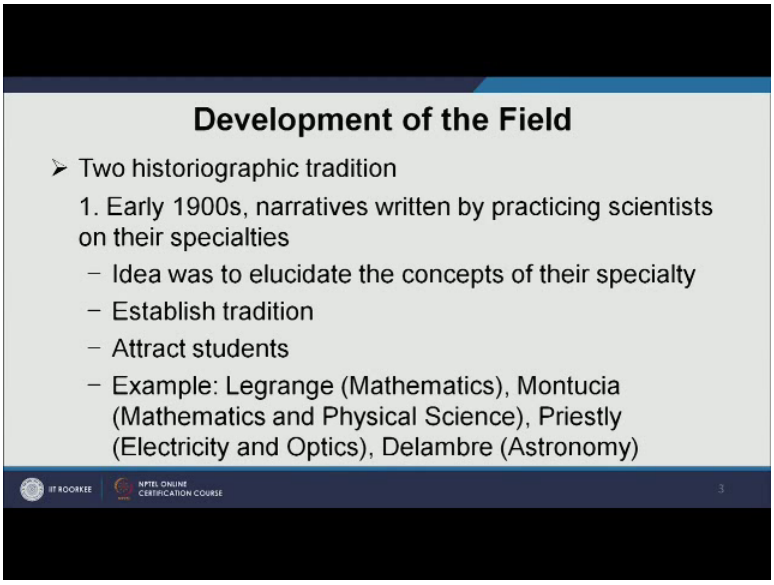

Shreekathe; history of science initially started with the practicing scientist, the professionals, particularly the eminent ones, the eminent scientist, they wrote on their own subject matter on, they wrote on the history of their subject.

This practicing professionals, while writing about the history of their subject, history of the sciences, that they were in intended to elucidate the concepts of their specialty. They wanted to explain for though the different concepts which are part of their subject matter. They also wanted to establish a scientific tradition of their subject. The subject of the field as a separate scientific tradition; that was also one of their aims. They also end by writing such books to attract the students into the gambit of that particular field of science.

Now, if you look at the examples of such kind of scientific work done by professionals themselves or the practitioners themselves; there is LaGrange, who has written a book on mathematics, who has written a where he has addressed the historical development of historical evolution of mathematics montucia, who was written history of mathematics and physical sciences. Priestly has written a book on electricity and optics where he has dealt with the evolutionary growth and development of electricity and optics then Delambre who has worked on history of astronomy.

These are examples of scientists or practitioners of particular fields, who have written books in their subject matter as historians of science themselves. As I told you the idea was to elucidate explain the concepts of their specialty or the branch of scientific

knowledge that they are part of. Idea was to attract more student's researchers into that field to get them interested in such field so that they can pursue this further research in that field and take the scientific knowledge further to advance scientific knowledge in those fields. And they are also through the process establishing a separate tradition of that scientific knowledge of that scientific field.

Now, the second historiographic tradition is philosophic in nature. It has philosophically objectives. So, we can put it in the form of philosophical concerns of creative activity in the history of science. Francis Bacon was one of the first who emphasized upon the tracing of uses of human reason and scientific subjects in the histories of learnings, in the history of scientific subjects or history of learnings.

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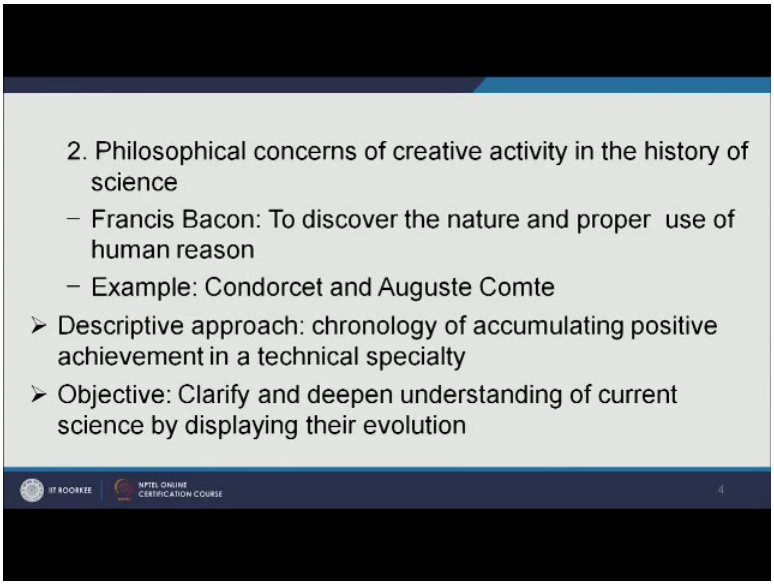

He wanted to look at how human reasoning has developed through, such scientific works over a year of over a period of time over generations over centuries.

Now, a prime example of such creative activity taken up is that of by Condorcet and Auguste Comte. They were highly influenced by Francis Bacon in their historical surveys of western scientific thought. Because they based the normative guidelines of true rationality, while doing historical surveys of western scientific thought.

Though in their survey of western scientific thought in an a historical context, they made use of (Refer Slide Time: 09:55) one of the major trends of history of science and the

early periods is that, they are essentially chronology of accumulating positive achievements in a technical speciality, how scientific knowledge has been incremental in every technical specialty in every sub branch of science. That has been the focus of historians of science to look at such accumulating scientific developments in difference of fields. A chronology of such accumulating scientific achievements has been the concern of historians of science. Idea? What is the idea? What is objective? Is to further depend and clarify the understanding of current contemporary science by displaying the evolution. By displaying, by looking at the evolution of scientific knowledge in different specialty, there trying to clarify and depend further understanding of the current scientific knowledge, contemporary science. How the contemporary science of contemporary technical specialties have evolved over a period of time. And that is done through such understanding and discussion of exploration of chronology of accumulating positive scientific knowledge in different technical specialty.

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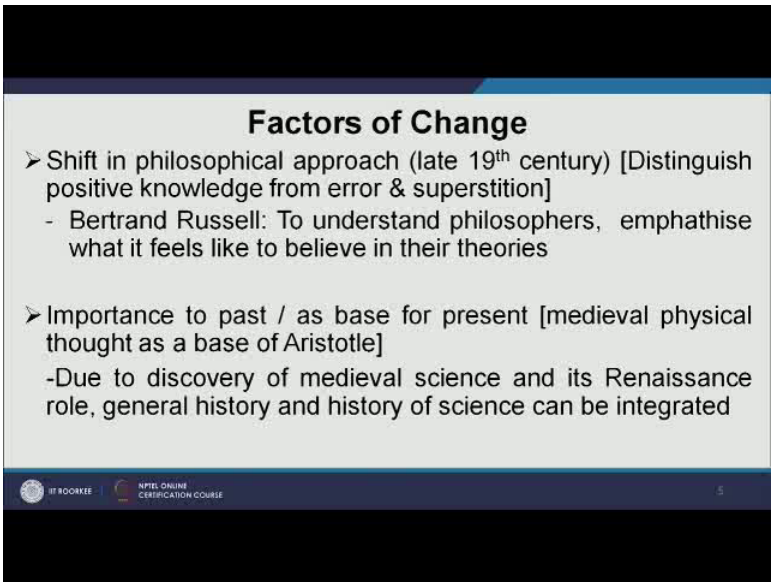

Now, there are certain factors of change which has led to such evolutionary approach and history of science. One of them is that sift in the philosophical approach, where there was an attempt or there has been efforts to distinguish positive knowledge from error and superstition. For instance, Bertrand Russell he said, and this has been the history of science here has been highly influenced by the philosophy of science, the philosophers. How philosophers looked at their own subject and the past philosophers. How did they

evaluate the contribution of the past philosopher? Bertrand Russell said a philosopher said, it is by empathizing with them.

Do not look at the past philosophers with reverence with respect. Do not look at them with contempt, do not criticize them. But empathize with them. Be one of them to understand get into the mind of the philosopher, who is made such a particular contribution. How and why the philosophers thought it wise to make such argument. You have got to empathize with the philosophers and that idea has been transferred to history of science, where the scientists they look at the history of the science the subject matter how it has developed through the scientists themselves. How the scientists have looked at their own subject matter, what they were intending to invent. Many of the times, what scientists intended to invent is not, what they came up with finally. What the problems they worked it, what are the objectives they had, what are the intention they had, while they started their experiment the research.

One of the ways, in which history of science was written was by looking at, how the scientists themselves drew material from the past. For instance, those an importance that has to past for tracing the evolution of scientific process. Like, if you want to understand the 17th century science, if you want to make sense of the development and or significance of 17th century science, we must look at the medieval science, that is one of the ways to understand, how 17th century science has developed. Go back in time, look at the origin the base of 17th century science in the medieval science, and the sciences that developed prior to that.

Due to discovery of medieval science and it is renaissance of role, the general history and history of science can be integrated. Now this is a third historiographic tradition, looking at the positive achievements in science as a whole, where there is an argument that the general history of science can always replace, the history of speciality sciences. Because this general history of science will capture the development in scientific knowledge as a whole.

You do not have to have a history of speciality sciences, we can have a general history of science for the scientists to look at the history of sciences of all the knowledge streams, and look at the positive achievements as a whole; that is a third historiography tradition. Now this particular tradition of general history of science replacing the history of

speciality sciences, has not found favour of led, because even if you are a tremendous scholar a great scholar of history of science still your scholarship would not be able to find a coherent narrative and the different scientific tradition. They would not be found the such scholarship would not help to locate a common evolutionary pattern of all these technical sciences, of all these speciality sciences.

This idea of general history of science, can replace the history of technical specialities is out of favour with in history of science, within the discipline of history of science or many historians of science they say that this idea is untenable, that even if you are a great scholar of history of science. Still you cannot find common evolutionary pattern, some common coherent narrative and all these technical specialities, all these specialities. This is also for the led to the impossibility of looking at past, when you are trying to understand the division of current scientific knowledge. When you are looking at the bifurcation of scientific knowledge in 2 different fields and subfields, we tend to look at the past to look at how it has developed in the past, how it has bifurcated. But that has also become a difficult task, near impossible task according to Thomas Kuhn.

Now, there have been some, attempts at general histories of science like for instance in the works of Paul Tenure and George Sutton. They are the people who have attempted to write the general history of science. And for them it is an attempt to understand the current division of knowledge in science curricula. But of late such effort such argument has been negative saying, that if you are a great scholar still it is difficult for you to find a common coherent narrative in the evolutionary pattern of all these technical specialties. It is difficult to trace the evolution of different branches of science in the current times. You cannot find the roots of such bifurcation in the past. Then there is another way in which history of science or the historians of science have been influenced. And that is by looking at the role of institutional and social economic factors in the development of science. Sciences have developed in response to specific social needs economic incentives are there some institutional factors. There some political support or directly or indirectly certain religious doctrine has helped develop sciences at particular period of time.

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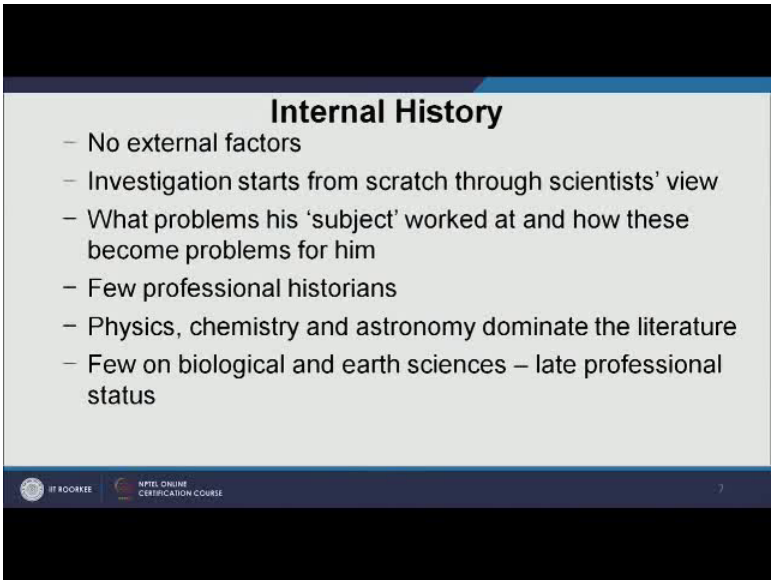

That is also one of the concerns of historians of science by looking at the role of institutional, and socio-economic factors in development of sciences. Now we come to the internal history of science. The internal history of science is concerned with substance of science as knowledge; whereas, the external history of science is concerned with, the social activity of scientists in groups in particular social and cultural context. One of the important ways in which internal history of science has developed is by looking at the science from it is scratch. Looking at the science from the scientist point of view.

What the scientist look at, how the subject, here the subject refers to the scientist. When you are writing a history of science, you are looking at the contribution of different scientists, and for them the historians, such scientists become the subjects. Hence what problems his subject, that is what problem the scientists themselves worked at. Which is being investigated by the historians of science. How this became problems for them? How this problems were identified by the scientists? How it became a problem for them? How they went about researching this problem? What is the solution? What are the factors that led to the invention or discovery in that field by that particular scientists?

Now, there have been few professional historians also, who have looked at the history of science, now this professional historians are from the field themselves. They are the practicing scientist, who have written professional account of the history of their science. Now in the history of science in particular, what has been found? According to Thomas Kuhn is that physics, chemistry and astronomy has dominated the literature of history of

science. When you look at the history of science mostly the dominant literature is the history of science, or history of physics, history of chemistry, history of astronomy. There have been the major contributors in terms of history of science mainly because that this sciences have been well established long time back. Hence there have been many investigations into the history of this sciences, history of astronomy, history of physics or history of chemistry. But they have been very few on biological and of sciences. Mainly because of his delayed professional status. Biology in essentially was in the medieval period was associated with medicine and physiology.

It took time to establish itself as a separate field of scientific enquiry, hence such a delayed professional status, delayed status as a scientific enterprise in itself probably led to lesser histories of biology in the last 100 years, that is Thomas Kuhn gives or that is the same case with earth science also the delayed professional status led to less, historical work in those areas, and the areas of biology and earth sciences. Now even, if there some histories written on biology, mostly it concerns itself with 19th century Darwinism or 17th century physiology.

But this history of 19th century Darwinism; for instance, does not look at the history of other technical specialties of that time. Thomas Kuhn argues that the, technical specialties which was in existence during the Darwin's period it provided a body of problems and data to Darwin to work upon them and which led him to come up with his theory of evolution. So, in the absence of exploring of history of technical specialties which are contemporary to Darwin's evolutionary theory; it is very difficult to establish, when you read this histories of Darwinism. It is very difficult to establish how it can be original contribution in itself, forget about as original contribution and science itself.

Such efforts were at best bismal patchy works, for instance in biology. Well, those no attempt to link Darwinism with the other technical specialities of that time, hence this exercise becomes futile according to Thomas Kuhn. There have been very few almost negligible history of social sciences. One example of history of social science can be given is that of borings history of experimental psychology or history of American anthropology. These are 2 examples that has been cited by Thomas Kuhn as examples of history of social sciences.

Now, if you look at the external history. There have been 3 types of external history of science. One is a study of scientific institutions. Where this idea has been to set science in a cultural context in a social context and the one first attempt of this kind is the study of scientific institutions. Bishop sprats study of royal society of London is an example. Or Guerlacs professionalization of French chemistry is an example. Now for that matter Scofield's history of lunar society or Caldwell's study of England or Duprees study of US. These are all examples of study of history of scientific institutions.

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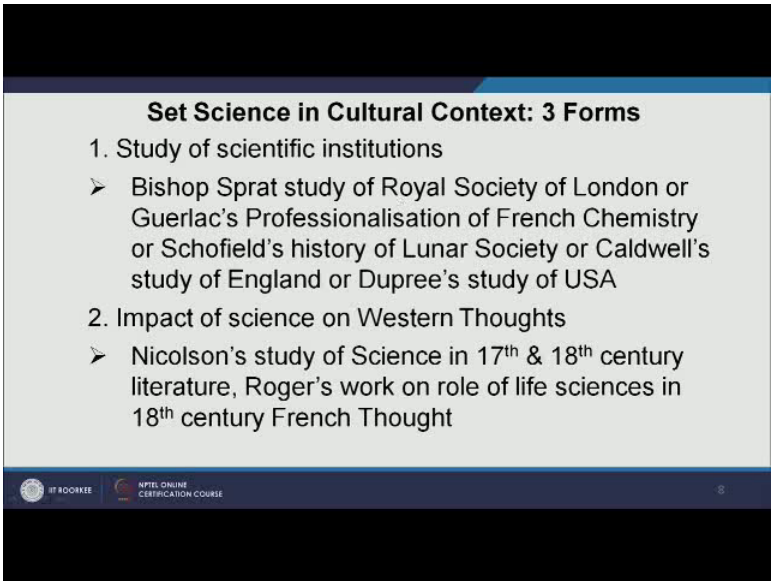

Which is mostly of use to historians in general and historians of science in particular. The second attempt with an external history of science is looking at the impact of science on western thought process. How scientific ideas have impacted upon have an effect on extra scientific ideas, on philosophy, on religion, on literature, on politics? For example, Nicholson's study of science in 17th and 18th century literature or rogers work on rule of life sciences in 18th century french thought can be cited an example, within this attempt, where the historians of science have looked at the impact of science on western thoughts.

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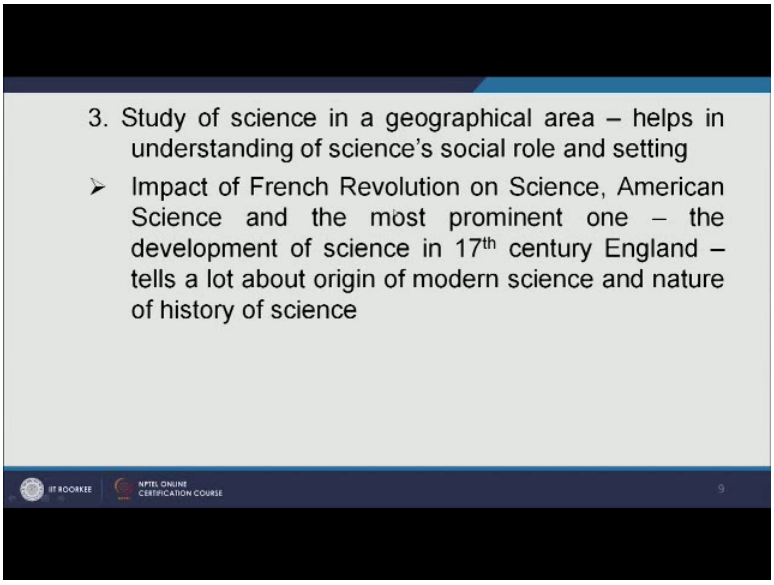

The third attempt of within external history is that of study of science in a geographical area. Essentially though it may appear limited, that if you limit your study of how french science has developed, or how American science has developed, or how Indian science has developed. But still it gives you a picture of the social setting the cultural context within which science has developed. Like for instance you can talk about the impact of french revolution on science, American science and the most prominent one. The development of science in 17th century England a original thesis by Robert Morton, which tells a lot about the origin of modern science as well as the nature of history of science.

Now, we come to the Morton Thesis, because he is the one who established this field called sociology of science, by looking at the different social needs affecting, determining, governing, scientific research. And to do that he took the example of 17th century England, which is at the height of industrial revolution. And he looked at how social needs of that time under the impact of the Baconian reasoning, inductive reasoning and scientific experiment led to development of scientific research, led to technical innovations. How the social structure social needs, led to development of scientific and technological research in 17th century England.

Now, for that Morton drew inspiration from 2 domains. One the Baconian influence or that is Francis bacons influence on the scientist of that era, and second puritanism a religious doctrine, how it led to further exploration of nature. Which ultimately resulted in scientific developments. But this principle this idea that Francis Bacon had a lot of

influence on scientists of 17th century England in terms of emphasis on experimentation, observation instrumentation, has not found favour amongst the current historians of science.

Thomas kuhn says, there has been lot of arguments; which supports as well as criticizes the Morton Thesis. For instance, one argument is that the Francis Bacon. It is ideology or his argument is his prescriptions about scientific method, was not only confined to scientist. It was not uniformly accepted across the class, it was not uniformly accepted across culture. Many of the scientific inventions of 17th century is a result of internal evolution. For instance, Galileos scientific contribution, many scholars argue is a result of traditional thought experiments brought to new perfection. Many of the inventions and scientific contributions in the 17th 18th centuries have been the result of class of genius. Result of brilliant minds of certain individuals nothing to do with the Baconian principle, it had nothing to do with puritanism, there was a emphasis on justification through works, there was an attempt to commune with god through nature.

Those puritan puritanism principles did not work with many of the scientific developments that came about in 17th 18th century mostly, it was a result of internal evolution or class of genius. But still all this criticism does not negate Robert Martins original contribution to sociology of science, where he established a close relationship between society and science, social needs religious doctrine and scientific development. Finally, we come to the last part of the discussion of Thomas Kuhns history of science.

But he says, that now a day's better histories of science are being written more practitioners are emerging, who are writing histories of science and it bodes well for further research in the history of science. Because one of the ways in which history of science can be looked at is that it is rich depository of old ideas. Now such old ideas can also be drawn upon to solve and explain many of the current scientific problems, 2 fields, which it is connected to that is history of science is very much linked to philosophy of science as well as sociology of science. Many of the philosophers of science now ad ays as coon ports like fariba and lakatos prope, all these people have realized that the traditional philosophic view of image of science is inadequate.

They are looking at alternatives and for such alternatives history of science provides the platform. Sociology of science, can also take lot of help from history of science in the

sense that history of science helps sociology of science to understand and explore the shaped of the structure of scientific enterprises, structure of scientific disciplines. And a term sociology of science helps history of science in science administration and science policy making. And finally, he says as direct price has point this term science of science. Science of science is also emerging within the history of science as a separate and interesting field of enquiry; where the idea is the theoretic analysis of structure and behaviour of science itself and mostly the technique used here is econometrics, history and sociology to understand the science of science.

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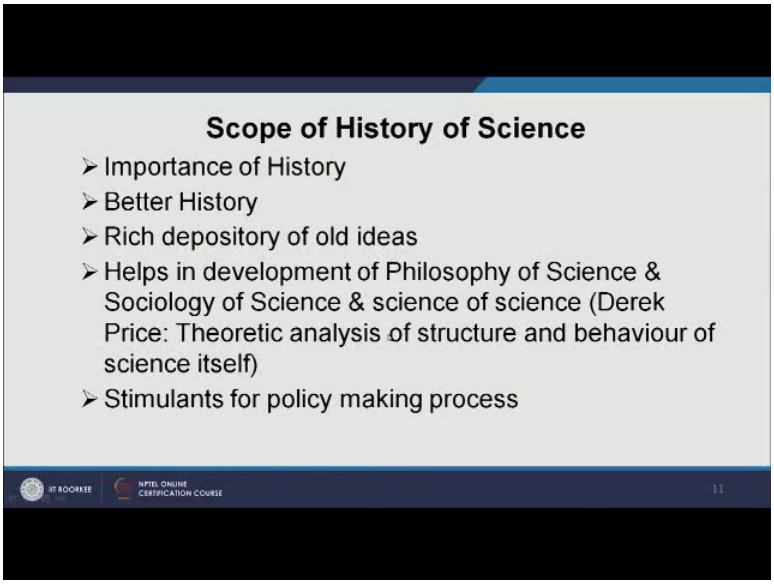

The history of science holds immense potential for policy making, it is a great stimulant for policy Suzhen science. And that is how Thomas Kuhn would explain or describe the importance of science the history of science. So, today we discussed the history of science in the next lecture. We will talk about positioning of social sciences and humanities within technology institutes the philosophy and the current state of affairs in Indian context.

Thank you.