

INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

NPTEL

**NPTEL ONLINE CERTIFICATION COURSE
An Initiative of MHRD**

Science, Technology and Society

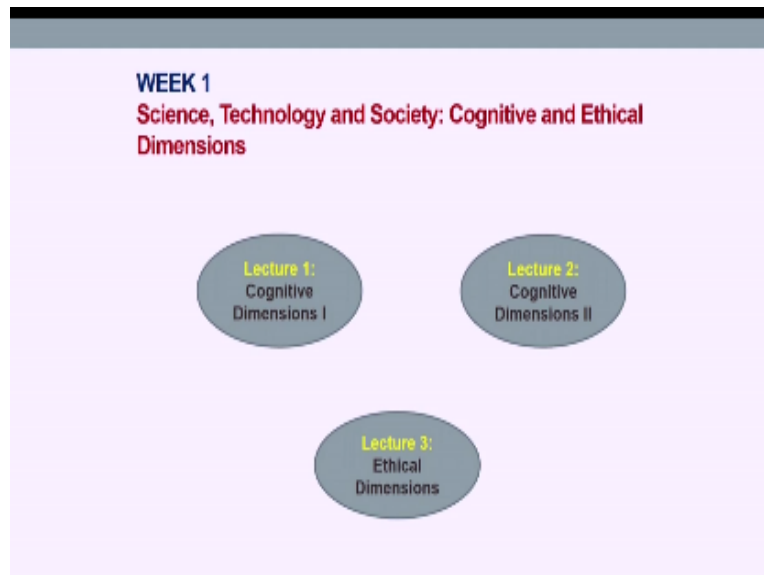
By

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A very warm welcome to the last lecture on the course on science technology and society, in the last lecture what we are going to do is that, we are going to discuss all the lectures in chronological order in a in a thematic order okay. We are going to sum up the entire course I mean week wise and lecture wise okay, all 12 weeks as well as the lecture component which are very much implicit in those respective works okay. What we did at the outset, let me started with the interrelationship between science technology and society okay.

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And the kind of cognitive and ethical questions which are involved in this interrelationship between science technology and society okay, the lecture 1 it covered a part of cognitive dimensions and the second part was covered in the lecture, in the second lecture and the third lecture covered ethical dimensions okay. What we did in the first week itself, we started with certain epistemological questions.

What does a epistemology refer to, epistemology refers to a body or theory of knowledge, why is it, so know precisely because of the central political philosophical questions which epistemology addresses, that is what is knowledge? What counts as knowledge? How is knowledge produced and so on and in the epistemological questions, we also discussed what ethics refers to. Ethics refers to a study of nature of conduct.

Why is it so, why is it regarded edge a study of nature of conduct precisely, because of the central political philosophical questions which ethics addresses. What is good, what is bad what is right, what is wrong and so on and then we discussed thematic preliminaries of the relationship between science technology and society, now I mean what is technology we discussed technology is the medium through which human beings have been interacting with nature.

When I say nature T, it includes both natural and social phenomena, then what is science may be an inquiry, science may be a method, science may be an institution, science may be an ideology, science may be called science may be known, science may be considered, a transition from the world of a know ability to a world of no ability okay. I mean science is an inquiry into the nature and limits of a particular knowledge that is scientific knowledge.

When I say nature of scientific knowledge I mean this the scope and a matter of scientific knowledge but when I say limits of scientific knowledge, I do not by limits I do not mean limitations, by limits I mean under what limiting conditions science is practiced or pursuit okay we have already discussed this and thereby we try to provide the interrelationship between science technology and society.

There are different perspectives on this relationship there are different perspectives on HTS there are different models of HTS, namely the linear model or hierarchical model, secondly the

interactions model and thirdly the embedded model okay. we have we have discussed this and what we have we have discussed in the linear and interactions model that they depict these two models, the linear or hierarchical model and the interactions model, they belong to or they come under the internalist characterization of science okay.

As once Karl Mannheim said all knowledge, except scientific knowledge is socially and culturally conditioned okay, where is the embedded model suggests that the relationship between science and technology is symbiotic science and technology are not separate entities society is not outside, the preview of science and technology or science and technology are they do not fall under, they do not they do not they cannot be isolated while examining this interrelationship rather both science and technology are very much a part of social formation, cultural formation political formation, economic formation is right.

That is why the embedded model comes under the external reached account of science, as David Bolo said all knowledge including scientific knowledge is so socially cost okay, even when Kuhn said science should be seen in terms of its historical integrity. What Marx said that science what is science is a social craze okay, that is why whenever we discuss science and technology or science technology and society okay, we must examine them okay.

Not in isolation but the way they have been embedded historically okay, in cognitive dimensions okay part 1 and part 2 okay, what we have discussed that we have we have tried to go beyond we have tried to go beyond, the embedded model is once said okay science as a force must go beyond the absolutist idealist conception of the imminent development of science on the one hand and historical relativism of those, who consider science to be a purely conventional social construct on the other.

I mean when I say absolutist idealist conception of the Emani development of science, I mean the internal is account of science when I say historical relativism I mean I referred to the externalist account of science okay, science must go beyond even Hari Babu he suggested that the distinction between the internal and the external worlds of science is not received but force okay.

We must go beyond such extremes okay, in cognitive dimensions again we have what we have discouraged I mean to challenge such internally should accounts of science okay, we have discussed technological determinism what is their technology, to determine the technological determinism refers to the idea that technology develops as the sole result of an internal dynamic and then unmediated by any other influence mould society to fit sifts patterns to fit its patterns okay.

But what we what we find is that technology is very much a by-product of social formation okay, the neutrality of Technology very often you will find that people very often say that no even scholars intelligence say, they say they suggest that no technology is neutral okay but the neutrality of a technology very much depends on open the way it is designed and the way it is controlled, that is how we gave the example of Robert Moses construction of the new year range okay.

How the construction of the New York breeze by Robert Moses reflects racial prejudice and class bias, that saw technology is not neutral okay, it is not neutral. Technologies have various political properties what matters is not technology itself but the social or economic system in which it is embedded, missus whenever you talk about technology within cognitive dimensions you are discussing okay.

Whenever you talk about machines structures and systems of modern material culture okay, they are often examined these artifacts misses structures systems of modern material, culture technologies, that often examined in terms of productivity in terms of efficiency in terms of positive and negative and environmental effects but the but the most important thing is that it is very important to examine the way missal is structures systems of modern material culture technologies they embody power and authority okay.

This is important that is why we discussed room for classification of two technological systems one is authoritarian and the other democratic authoritarian technology I mean what mum port refer to you know, that is authoritarian technology is often system oriented immensely powerful

but inherently unstable. Whereas democratic technology human-centered relatively weak but resourceful and durable and hence sustainable okay.

In and that is why we discussed how the context of knowledge production has been undergoing transition, no I mean the way science and technology they were once considered curiosity-driven research, now they have become a part of contract obligations. Once they were considered a part of public resource now they have become a part of intellectual property and such cognitive and political changes have significant implications on political economy label agriculture, health environment and so on okay.

And such cognitive and political changes that we see when I say cognitive qualitative, cognitive change in science, I mean the shift occurs from mono valet to polyvalent knowledge we have already discussed okay. I mean how triple helix model supersedes both traditional disciplinary boundaries and more to knowledge production created in the context of application, I mean when I talk about triple helix model of innovation, I mean Government University, I mean academia and industry private R&D institutions they try to collaborate with each other okay.

And the political change that I refer to I mean the safety towards fracturing of the authority of nation states, with consequent pressures to rethink the forms of democratic governments okay and then in the third lecture we discussed ethical dimensions okay. In ethical dimensions so far as the relationship between science technology and society is concerned we have discussed more of science okay to do science imperatives of science goal of science and then we moved on to how we have we have tried to look at motor Lionel to you of science in the present day context also okay.

And that we discussed when we discussed when we try to dwell upon in equalities in science which will come in we have come, we have this we have covered in the fifth book okay. Now in and of science then what do mean what do we mean by ethos of science to of science refers to the effectively termed complex of values and norms which is held to be binding on the man of science and these values these norms are off often expressed in the form of prescriptions preferences and policies okay.

We have discussed prescriptions, preferences and permissions I mean prescriptions you know their norms their even doctor, prescribes right, when I say prescriptions they are such norm switches guide, which are guide which are bound by law legal bound okay preferences you know choices permissions. I mean it requires somebody to allow the goal of science according to Martin is the extension of certified knowledge okay.

Which can be spelt out in terms of its technical methods what Martin try to refer to technical methods, I mean empirically confirmed and logically consistent statements of regularities these are all predictions okay. The imperatives of science for Merton derive from the goal and the methods, then what is the goal of science imperatives of science if they are derived from the goal as well as the methods if the goal of science is the extension of certified knowledge and the methods.

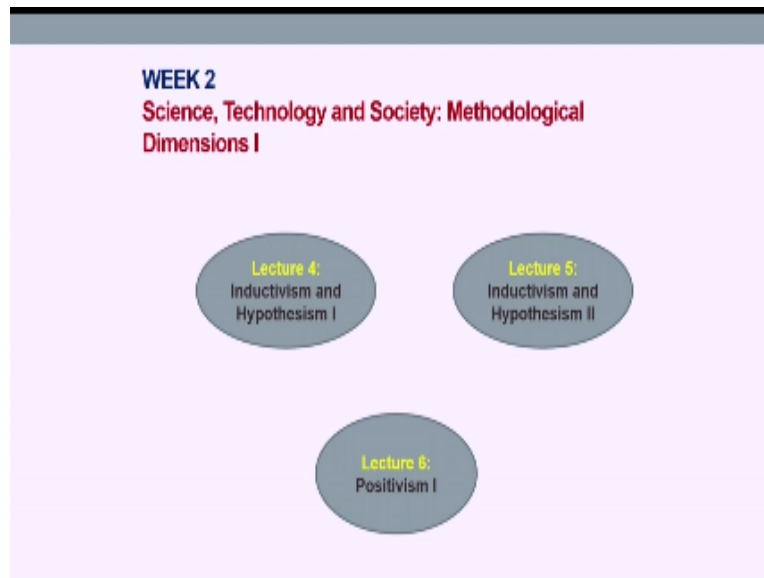
According to Merton they include empirically confirmed statements of regularities be consistent signal, is certified knowledge and they must follow logically consistent statements of regularities okay. Then what are the institutional imperatives or ethos of modern science the tools of modern science are fourfold for Merton okay, universalism, communism, disinterestedness and organized step decision, what does universalism refer to universalism refers to I mean the acceptance or rejection of a scientific claim should not depend upon the personal or social background of the individual offering that claim.

Communism what we say what Martin referred to that that whatever development of technology that we encounter, we witness to be must be said by the community of scientists should be said by the collective okay, individualistic orientation of science must be scorned off okay. That is why when we talk about community main science okay, it acts against the present-day intellectual property, when you look at disinterestedness as another ethos of modern science propounded by Martin.

I mean science should go beyond interests and ideologies the practitioner of science must not be bound by any kind of interests or it George, what did organized skepticism refer to organized

skepticism refers to the fact that we must temporarily suspend our judgment we must postpone our judgment until and unless all facts are at hand okay. This is your methodological imperative technical imperative if you look at Moulton any choice of moral sense okay this organized.

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Then in this second week I mean we started with fourth lecture okay we started with the methods of science, I mean science technology and society methodological dimensions part one in this fourth I mean in the third week part two in the fourth quake part three okay. We took we discussed methodological dimensions methods of science in three weeks in nine lectures okay, we started with inductive is Diamond hypothesis, you then positivism then Karl Popper then popper versus Koon and then all fair a bit okay.

Then we tried to summarize science okay, in the in the whole period of three centuries from 17th to 19th 2 view stand out prominently, as answer to the question I mean when the Aristotelian question that what is the method of science, one much inductive, is if the other hypothesis. Inductive ISM suggests that the method of science is the method of induction, whereas hypothesis, no the method of science is not the method of induction but the method of hypothesis.

Inductive vision was founded by Francis Bacon on where edge hypothesis was founded by Rene Descartes, perhaps for this reason inductive ISM is also known as Baconian philosophy of science, whereas hypothesis is also known as Cartesian philosophy of science okay. Inductive is rooted in imprecision according to which only those ideas which are traceable to sense experience are legitimate, whereas hypothesis is grounded in rational region.

According to which a significant portion of human knowledge cannot be traced to and therefore is independent of sense experience, inductivism looked at certainty and breadth as the hallmarks of scientific knowledge, I mean that means science must aim at knowledge which is definite which is certain on the one hand and on the other plot in the sense that it must encompass more and more of the world, we seek to know okay.

The search for certain or definite knowledge laid in definitions to legislate that science must confine itself to observations, since it is only our observations that we can be subtle in other words science according to inductive is must not make reference to anything on objective, that the means of realizing knowledge that is brought back on from found in the principle of induction, which allows us to go from particular observations to generalizations.

Thus according to indicate science must aim at arriving yet with the help of the principle of induction generalizations, which cryptically contain knowledge of indefinite number of a number of as unmet observations. Then what are the processes which inductive follow, now then one must first collect observational data without any recourse to theory without recourse to any theory, then one must put forward a tentative generalization which one has to verify.

And once verified the tentative generalization becomes a law enabling us to go from a limited number of already made generalizes observations, then the M of Science in the in the finished schema is to arrive at launch that is established in generalizations which are only cryptic statements of regarding as yet unmet observations by accumulating such established inductive observations inductive exclaimed, that will have at our disposal an enormous amount of observations the totality of which constitutes reality okay.

Then science according to the interpretation schema, thus begins with observations remains at the level of observations and interest observations, if according to inducting is inducting inductive it is the hallmark of scientific knowledge, the hallmarks of scientific knowledge are certainty and built then according to hypothesis in their novelty and depth, that is to say science must aim at knowledge she is new in the sense of being trans observational and deep in the sense of referring to entities underlying the phenomena given to us in observations.

Then science then in the inductive schema science limits itself to observation essence whereas in the hypothesis schema knowledge is produced science is produced only when we go beyond observations. In other words we are edge inductive insist that science must remain from beginning to end at the level of observations hypothesis maintain that science begins only when it goes beyond observations.

Then according to hypothesis in genuine science must aim at or rather genuine science must not remain content with generalizations based on observations but not seek to explain observations in terms of unobservable deeper entities and processes, the term hypothesis in 17th century meant a statement regarding unobservable entities and processes though today by hypothesis we only mean a tentative solution to a problem or hunch. Whereas there is no place for hypotheses in the inductive schema the hypothesis maintained that the aim of science is to generate hypotheses to explain what we observe.

The term theory means a statement of a set of statements the statement about a state set of statements involving at least one theoretical term okay that is what we have discussed a theoretical term for example electron proton etcetera unlike an observational term does not designate observable or mainstream measurable. Inductive or empiricists and empiricists maintain that anything which exists must be observable okay.

Hence inductive is do not admit that theoretical term designates real entities they contained that theoretical entities are fictitious entities, I mean are fictitious entities conjured up by us for the purposes of either economic description of observations or predicts. On the other hand or rather

to buttress the argument okay to strengthen the argument I mean according to inductive theories are not descriptions of a world of a real world of unobservable, as against this the hypothesis maintain that the theoretical terms designate real entities not given to us in observations and theories are descriptions of a real world of unobservable entities.

Therefore while hypotheses are called realists inductive is are called and is okay we have discussed this and then, we have also discussed the principle of induction, we have discussed Hume, have discussed Mills principle of induction and then in the in the 20th century okay, I mean which begins with the emergence of a school of thought called positivism, in the sixth lecture what we have discussed positivism and in the seventh lecture we have tried to end positivism there in the second part I mean the past part of positivism, we have discussed how positivism is an extremely well know until recently very influential theory of science.

And its nature it is a, closely knit set of minutes formulated with an admirable amount of clarity and consistency okay. What are the central tenets of positivism okay the central tenets of positivism that we have discussed first methodological, I mean that science is distinct from all areas of human activity or creativity because it uses a method unique to it, secondly methodological managing that there is only one method common to all that is only one method common to all sciences irrespective of their subject matter that is methodological management.

Thirdly inductive is that the method of science is the method of index, fourthly systematic verifiability that the hallmark of science lies in the fact that all scientific statements must be systematically verifiable, fifthly purity and indubitable of observations are pure observations or indubitable observations cannot be doubted it is only through observations that knowledge is produced in the positivist extreme. In sixthly there is a unilateral relationship between observations until observations lead to theory but theories do not click to observe business.

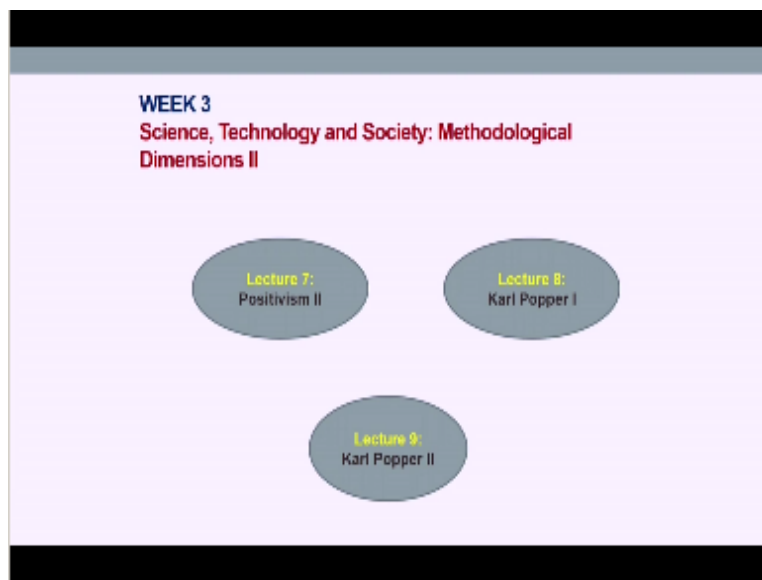
Then you one way relations in the positivistic okay in the sense, that future observations dependent where edge observations a theory independent okay. Seventhly we have discussed fact valued I could okay that facts that that there must be a dichotomy between effect and then facts do not have any value content or rather facts, do not have any value whereas values do not have

any factual content that is why I gave you the example that if I say this is your laptop this is your fact if, I say this laptop looks beautiful or ugly then I add value to it okay that is what facts are value neutral.

Whereas values do not have any factual content and we have also discussed how all explanation which involves, I mean we start with a set of laws then a set of statements describing initial conditions thereby we come to a we come to conclude come to come to conclude the explanation that we are going to make okay, I mean a set of statements describing the phenomenal to be explained that is the conclusion okay.

And if any theory any law which does not follow this procedure okay then it is considered illegitimate it is considered invalid okay and is subject to deductive normal logic okay we have discussed these things how observations presuppose theory where edge theory does not presuppose observations okay then, then in the seventh lecture we have we have ended I mean what we have discussed.

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I mean in inductive ISM there are three steps okay I mean first step refers to observational data without recourse to any theory second step tentative generalization which requires verification and the third step formulation of law in, in hypotheses if we one must start with a hypothesis okay the second state to state involves the hypothesis to be tested whether right or wrong and if it is wrong then it must be rejected if it is tested right then it must be accepted that is the conclusion okay in positivism we start with observation a set of laws.

A set of statements describing initial conditions and finally a statement describing the phenomenon to be explained okay in the in the we ended with we ended positive is in there in the third week in itself okay in the in the eighth lecture we started with Godfather okay such, such positivistic control of science that methodological, methodological monogyny inductive ISM systematic verifiability fact valued I could to make your attaining debate ability of observations and.

so on okay such positivist accursed role of science was most systematically attacked by karna who provided an alternative image of science his theory of scientific method one has won a lot of admirers both in science and philosophy whereas positivists tried to work out a sophisticated version of the view called inductive ISM poppers are to resurrect its rival namely hypothesis in what follows we shall consider I mean what, what we have discussed his views on the nature of Sciences along with his attack on positivistic theory of sense.

Okay what he how he followed I mean it might be pointed out that for popper the value of the philosophical interest in scientific knowledge lies in its ability to send light on the central question of philosophy what is the central question of philosophy football that is the problem of cosmology what is that problem of cosmology the problem of understanding the world including ourselves and our knowledge of the world is part of the world and in studying purpose contribution to our understanding of science one much bear in mind his general philosophical concerns which alone set in motion guide.

And lend me significance to his painstaking work on the nature of science ok the philosophical inquiry into the nature of scientific method according to popper must confine itself to the manner

in which scientific theories are evaluated I mean whether accepted or rejected popper refuses to consider as legitimate the inquiry into the way in which these theories are arrived at therefore according to popper philosophy of science must first confine itself to the context of justification.

And refuse to say anything about the context of discovery popper considers the creative process inland through which scientific ideas are generated to be unlamented to any rational explains okay and secondly an adequate philosophy of science according to popper must provide a criterion of demarcation between science and nonsense like positivist popper is convinced of the uniqueness and supremacy of science in the overall scheme of our activities aimed at knowledge equities hence both positivists as well as popper felt.

The need to demarcate science from the rest of knowledge acquisition activities that is why positivists who air inductive mists maintained that the hallmark of scientific knowledge or scientific theories lies in their systematic verifiability and popper replaces verifiability by falsifiability according to popper the hallmark of scientific theories lies in their systematic falsifiability popper maintains that what distinguishes science from the rest of our knowledge is not that scientific statements are verifiable.

But they are falsified the scientific theories are falsifiable according to popper in the sense that there they transparently state what circumstances lead rejects whenever scientific theories are advanced it is also stated under what conditions they turn out to be false so that they so that we try to obtain those conditions in order.

To falsify our claims then water the what kind of method that term you know or what kind of steps that popper followed it is the method of hypothetical deductive model which popper followed I mean for popper for popper one must start with the identification of a problem okay step one.

The second step suggests once the problem has been identified suppose in the context of inductive ISM we must one must start with observation in the context of hypotheses one must start with the hypothesis in positivism also one must start with observation but popper one must

start with a problem okay next time in researched whenever we do research weal ways say that one must start with a question.

Okay then once the problem is identified then we must provide a tentative solution to a problem or hunch that is called hypothesis then a hypothesis requires to be tested if it is tested wrong then it must be refuted it is subject to a few decimal and if it is tested right then it need not be it should not be accepted as in the hypothesis schema rather it should be corroborated that is keeping that hypothesis permanently tentative okay in the eighth and ninth lectures we have discussed Karl Popper okay.

And under what conditions it must be corroborated we have already discussed okay in the fourth week in and I mean third section on of methodological dimension third and final section in this course okay I mean we started with cool then popper versus spoon and then Paul Faraday moon rather Thomas Kuhn's the structure of scientific revolutions constitutes a turning point in the 20th century philosophy of science for according to cool the life of every major science passes through two stages which can be characterized as pre paradigmatic stage.

And paradigmatic stage during the prepare a dogmatic period or for science one finds more than one mode of practicing that science thus there was a time when there were different schools in astronomy which practiced astronomy differently so was the case with disciplines like physics chemistry and biology to their situation at that stage of their development was similar to the one which obtains today in the case of creative areas like art literature philosophy and even medicine where in divergent modes of practicing.

These disciplines coexist where is even today we speak of schools of art schools of literature schools of philosophy and systems of schools of medicine we do not speak of schools of astronomy schools of physics schools of biology etc this is because according to Kuhn areas like art literature philosophy and medicine did not incur haps cannot make a transition from pre paradigmatic stage to a paradigmatic stage.

So what characterizes the science or mature science according to Kuhn which enters the paradigmatic stage is the disappearance of scores is the disappearance of those divergences in other words the transition from the pre paradigmatic stage to the paradigmatic stage implies the replacement of morality by uniformity of practice when the science reaches the paradigmatic stage it becomes amateur or science in the present sense of the term.

Then what are what are the steps which Kuhn followed science I mean I mean progress of science methods of science first prepare a dogmatic stage from pre paradigmatic stage to paradigmatic stage paradigmatic stage to normal science normal science to and no marriage anomalies to no crisis from crisis to new paradigm mediated by a revolutionary science next icon also foregrounded the similarities between the Scientific Revolution and apolitical revolution okay in the structure of scientific.

And in and then we discussed proper cool comparisons you know proper versus cool some of the radical implications of Coons position can be brought about by juxtaposing his views with those of Popper the hallmark of science according to Popper is critical thinking in fact a science exemplifies critical thinking at its best since critical thinking considers nothing to be settled and lying beyond all doubt fundamental disagreements and divergent thinking must in fact do characterize things as we have as we have discussed according to Kuhn what constitutes the essence of scientific practice is normal science.

And we have also seen why normal science is a highly tradition-bound activity and activity made possible by a consensus among the practitioners who share a parody okay if Popper's is the essence of science is divergent thinking and fundamental disagreements then Kuhn's is this the essence of science in thinking and consensus okay now that is why Coon also said no that normal science what is normal science it is a traditional it is your tradition bound activities puzzle-solving activity if normal science is a probe tradition-bound activity.

Then for cool are evolutionary science is a tradition centering activity okay if I mean according to Kuhn the hallmark of science is tradition-bound activity in fact according to Kuhn what distinguishes science from the other areas of creative thinking is that whereas in science one

finds its institutional mechanisms of enforcing consensus the other areas suffered from perpetual disagreements even on fundamentals okay I mean.

And secondly if popper considers the individual to be the locus of scientific activity cool niche to us the status upon the scientific community both positivist as well as popper lubed up and Sciences as the sump as the sum total of the work of individual scientists working in accordance with a method though positivists and popper fundamentally differed on the characterization of that method as opposed to this individualistic account of scientific enterprise Kuhn propounds a collectivistic account of scientific activity.

Okay thirdly popper and Kuhn differ fundamentally in their attitude towards the transition from one theory to another in science according to popper we can explain every case of theory change in terms of certain norms which science always adopts and follows meticulously in fact scientific rationality consists in following these norms but whom contains that an adequate explanation of theory change must be in terms of the value judgments made by a community while making the choice hence according to phone records to the.

So called methodological norms explains nothing this is how we try to look at the comparison between popper and kunhs and then we in the twelfth lecture we moved on to fall Fair events reflections on the methods of science pour faire abs end in his classic against method outline often an archaistic on an artistic theory of knowledge repudiates the very idea of scientific method both on grounds of logic and history he calls into question fair event calls into question the time-honored belief that there is something called the method of science which distinguished science from the rest of our cognitive activities.

This traditional view of this traditional view which is called by fair event law in order philosophy of science maintains that there are certain unchanging norms which determine scientific practice no philosophers of science as we have seen starting from inductive is hypothesis positivists popper Kuhn and so on they though they differ in their account of what they consider to be the methods of science all of them maintain that there are at least two conditions which thought to be

mate which by any theory that is proposed for excellence these conditions are called consistency condition.

And correspondence condition according to the consistency condition the new theory must be consistent with the already well-established theory whereas according to the correspondence condition the new theory must correspond to the well-established facts according to fair event both these conditions are illegitimate in the sense that their acceptance hinders the progress of science by insisting upon the first curve by insisting upon the consistency condition the traditional philosophers of science both positivists and your less popper in or loop the fact that the so called well-established theories may themselves be faulty.

And their faulty character might come to surface only if we allow acceptance of the new theory provisional in other words if a new theory inconsistent with the existing theories which we believe to be extremely well supported the fault may not be necessarily with or may not necessarily be with the new theory.

But with the latter who are serious limitations may become obvious to us only by adopting an alternative it that is to say by insisting upon the consistency condition we may be to ting the chances of a very good Korean woman blind to the serious Laconia of the existing theories which we might miss only.

Because we remain confined to these theories however we may never become aware of these new facts unless we transcend these theories and adapt and alternative just as we cannot become aware of all the defects of our own society unless we look at it from the point of view of another society similarly the correspondence condition to cannot be sustained by insisting upon the correspondence condition the traditional philosophers of science overlook the fact that the new theory might fail to correspond to facts.

Because facts themselves may degenerate to the sense they are interpreted consciously or otherwise in terms of at theory which is itself questionable and whose caution ability we have not realized since our thinking has been constrained by it given the given the fact that all

observations are Theory Laden it may be that what we consider to be observationally obvious might be absolutely wrong due to the incorrectness of the theory hence fair event says that a new theory must be allowed to grow even if it goes against well-known facts okay it may be mentioned here that of the two conditions.

The correspondence condition is more primary because the consistency can currently can be reduced to it for the consistency condition says that a new theory must be consistent with existing theories if the latter are supported by facts in other words the consistency condition seeks to guarantee that a new theory corresponds with known facts by being consistent with existing theories by rejecting both consistency as earnest correspondence conditions fair event advocates that a new theory should not be constrained.

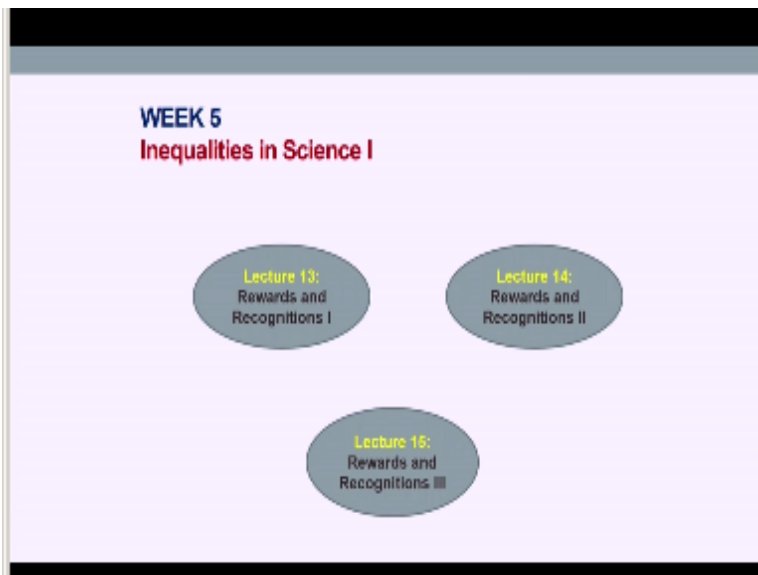
By the rule that it should first correspond with facts which we already know in fact fair event says that we must make deliberate attempt to develop theories which go counter to the so-called well-known facts that is why in a famous statement I mean that this is a famous statement which fair have been made that give me any norm you like I will show that it is violated at certain important phases in the history of science not by oversight or negligence.

But consciously and deliberately okay then what we have done in the twelfth lecture that rejection of consistency as well as correspondence condition okay becomes primary to the to the way far-ranging event tried to repudiate the very idea of scientific matter the basic thrust of the second third and fourth week lectures okay the I mean the basic thrust of this whole discussion on methods of science methodological dimensions is to foreground the various issues which philosophers historians.

And sociologists of science are grappling with in their attempt to understand the methods of science as a cognitive underpriced it may be mentioned that I mean it may be mentioned in this connection that social scientists usually work with some conception of science and it is met since such a concepts and very much informs their work it is necessary that they should free themselves from received no sense and naive ideas about science presented by textbooks.

And deeply entrenched in popular cycle all that discussion has all that this discussion has sought to achieve is to hammer the point okay that the vector hammer the point that thus that the pattern of scientific theory or the pattern of scientific thinking is too complex to be captured by a catalog of thumb rules compost Li provision presented as the principles of scientific method okay from here onward the chapter I mean that challenges to the received notions about science okay from this we in the fifth week fifth and sixth weeks we have discussed inequalities in science most onion reflections on inequalities in science part 1 and part 2 what we have done we have discouraged in the fifth week.

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I mean starting with 13th lecture then 14th and 15th lectures I mean the Matthew effect in science we have already discussed how the reward and communication systems of science are considered then what is that that in the in the case of Matthew effect that we have discussed I mean the metal effect of accumulated advantage described in sociology is a phenomenon sometimes summarized by the adage that the rich get richer.

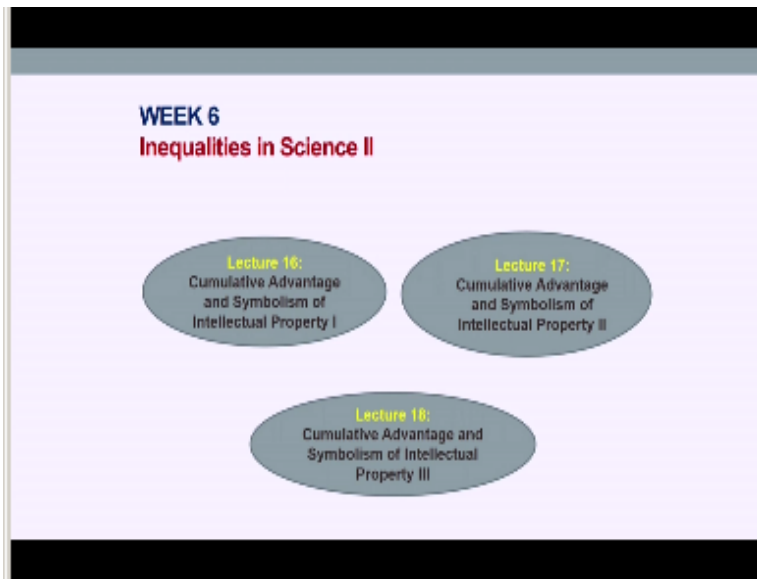
And the poor get poorer the concept is applicable to matters of Fame or status but may also be applied literally to cumulative advantage of economic capital the term this material effect in

science was this term was coined by sociologist Robert King Merton in 1968 and its name from the parable of the talents in the Bible. Merton credited his collaborator Herod Jakkuman as co-author of the concept of the Matthew effect. I mean what are these? I mean how inequalities in science are reflected in terms of rewards.

And recognitions okay. I mean psychosocial processes affect the allocation of rewards to scientists for their contributions. This is an allocation which in turn affects the flow of ideas and findings through the communication networks of science. Okay, and such conception is based upon an analysis of the composite of experience reported in Harriett JA Carmen's interviews with Nobel laureates in the United States. An upper letter drawn from the diaries, letters, notebook, scientific papers, and biographies of other scientists. Okay, in these. In this week, what we have discussed, we have discussed the reward system in science, the Matthew effect in the reward system.

The Matthew effect in the communication system, okay, and the Matthew effect and the functions of redundancy, then the psychology and the social and psychological basis of the Matthew effect and the material effect and allocation of scientific resources. In the sixth week, I mean, second part of inequality in science, we have discussed the cumulative advantage and the symbolism of intellectual property in three parts, okay, in sixteenth, seventeenth, and eighteenth lecture. In the sixth week, we have discussed the second part of inequality in science, again, the Matthew effect in science.

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I mean Martine and reflection on the Matthew effect in science to capture inequalities in science I mean the material fact in science I mean in terms of or inequalities in science in terms of cumulative advantage and symbolism of intellectual property in three hours I mean in 16th lecture in the 17th lecture and in the 18th lecture we have discussed this what is this cumulative advantage cumulative advantage in science refers to the social processes through which various kinds of opportunities for scientific inquiry as well as the subsequent symbolic.

And material rewards for the results of that inquiry tend to accumulate for individual practitioners of science as they do also for organizations engaged in scientific work to 'native advantage in science directs our attention to the ways in which initial competitive advantages of trained capacity structural location and available resources make for successive increments of advantage such that then the gaps between the haves.

And the have-nots in science as in other dimension of social life widened until a dampened by countervailing forces intellectual property in science I mean in the section on intellectual property in science Martin proposed the similar proportion the seeming paradox that in science private property is established by having its substance freely given to others who might want to

make use of it certain each teachers analyzed aspects of this intellectual property system chiefly in the form of public acknowledgement of the source of knowledge.

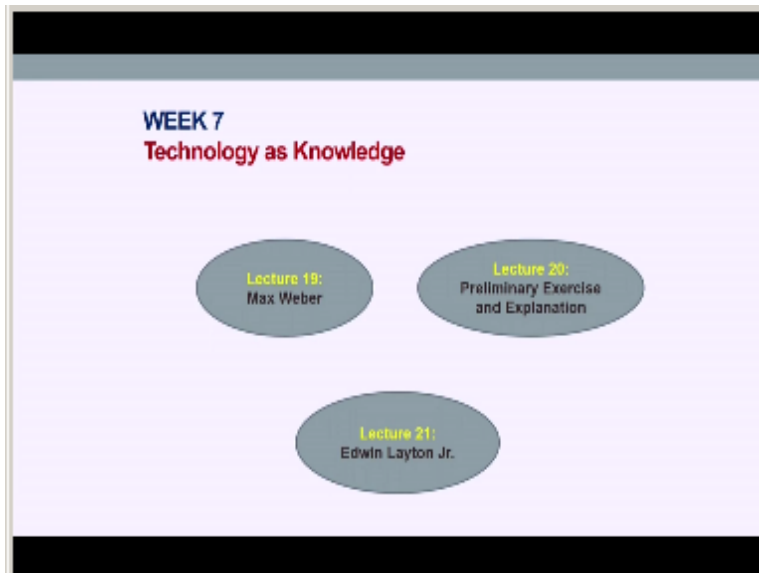
And information thus freely bestowed on fellow scientists relate to the social and cognitive structures of science in interesting ways that effect the collective advancement of scientific knowledge okay the world of science has been designed in such a way it is like a pyramid I mean it is like a triangle okay you will find more scientists with a very few rewards and recognitions at the bottom level and at the top you will find a very few scientists with more and more rewards.

And recognitions for example a prize will almost always be awarded to the most senior researcher involved in a project even if all the work has been done was done by a graduate student or a junior scientist let us say according to Martin and the world is peculiar in this matter of how it gives credit it tends to give the credit to only difference people okay and then we have discussed accumulation of advantages and disadvantages among the young scientists.

And junior scientists accumulation of advantage and disadvantages among scientific institutions organizations I mean if the what Martin tried to look at if the processes of accumulating advantage and disadvantages are truly athwart why are there not even greater inequalities than have been found to obtain then he went on to discuss countervailing processes.

And then he looked at the symbolism of intellectual property in science we have already discussed this and then what we have done we have discussed technology as knowledge okay to start with we started with Max Weber reflections on technology as knowledge in the seventh week I mean leg is ninth in lecture number nineteen however real reflection on the process of knowledge production.

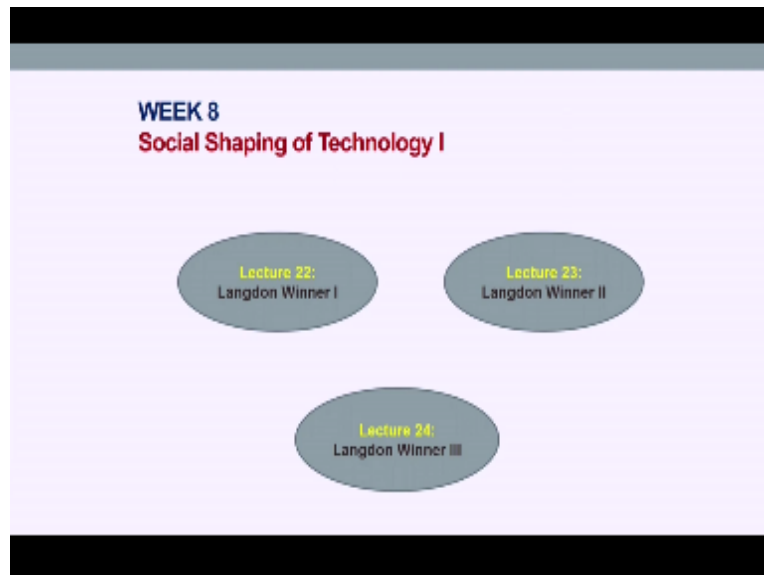
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As a composite product of a rather the way we were try to reflect on knowledge production agent involves an interpretive method that interpretive method is are conciliation between two approaches namely positivism we already know and neo-Kantian AJ okay and Weber all we have also discussed in Weber different types of Sousa lecture namely traditional social acts and effective or emotive so selection value rational social action and gold resonance or selection we have also discussed structure of authority in waived schema libel Authority I mean ideal typical bureaucracy traditional Authority.

And charismatic Authority and then we have done a preliminary exercise and explanation so far as inequalities in science is concerned and technology as knowledge before we moved on to Edwin Leighton juniors reflection on technology as knowledge okay in the eighth week we have discussed the social setting of Technology part one I mean social setting of Technology has been discussed in three with over a period of three weeks over a period of nine lectures we started with London winner then we disk then we have discussed Donald Mackenzie and Judy Walkman and then Thomas Edison and then we have discussed many, many authors reflections may be Marx's reflections may be their brother man is reflections on capitalism class gender City machine workplace

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And so on these three weeks we have discussed technology and social set setting of Technology we have discussed technology and politics then we have discussed technical arrangements as forms of order then we have discussed how technologies are inherently political I mean inherently political techno then we have discussed I mean in as if you go a little back to the seventh week I mean technologies knowledge in I mean we have discussed how things are commonly done or made.

And what things are done and made I mean this is also a part of social construction of technological systems now then we have discussed McKenzie and workman Edison's electric light electric bulb now I mean ability to design ability to control limitations of Hall's theory of science technology relation its position in Edison and electric light we have discussed history of ideas and the probe and the study of problem solving okay interpret I mean how Addison was not simply an entrepreneur but I mean not simply I said he was not simply an inventor.

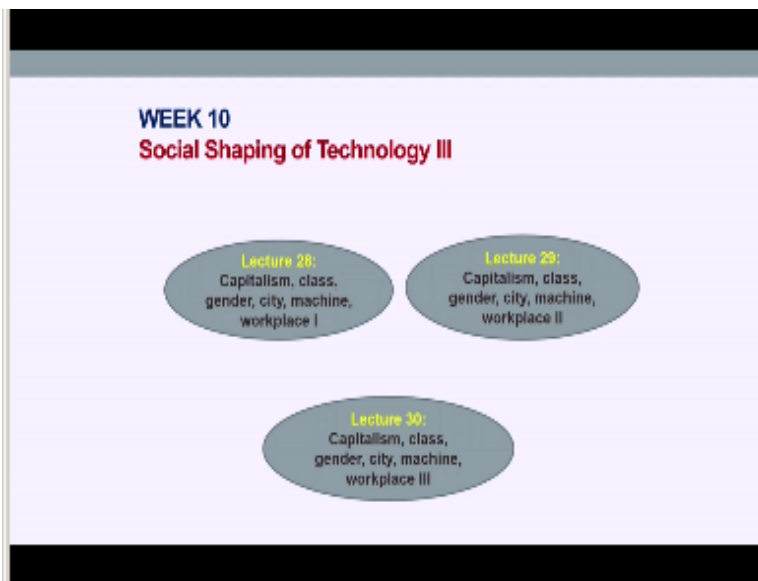
But also he may be called an inventor entrepreneur how technological determinism a theory of society then hard and soft technological determinism as a theory of society then technological determinism as a theory of technology we have discuss we have in math engine McMahon

reflections we have discussed the science SEP technology then technological shaping of technology and then economics Epping of technology and we have then therefore economics Epping is so sensible then we have discussed the relationship.

Between the between technology and the state and military technology theorizing the technology society relationship we have also discussed the social construction of technological systems as propounded by Wicker and pinch then actor network theory by lets and his colleagues then family g-men technology I mean gender and Technology ethnicity and technology how always reflects a known cybernetic organism.

Then Marx's reflections on technology as a by-product of the present mode of products and I mean capitalism and how class relations are mediated by that by technology I mean the Machine versus the worker then technology and capitalist control by Harry Braver man I mean how Brabant men rebel means reflections on labor and monopoly capital.

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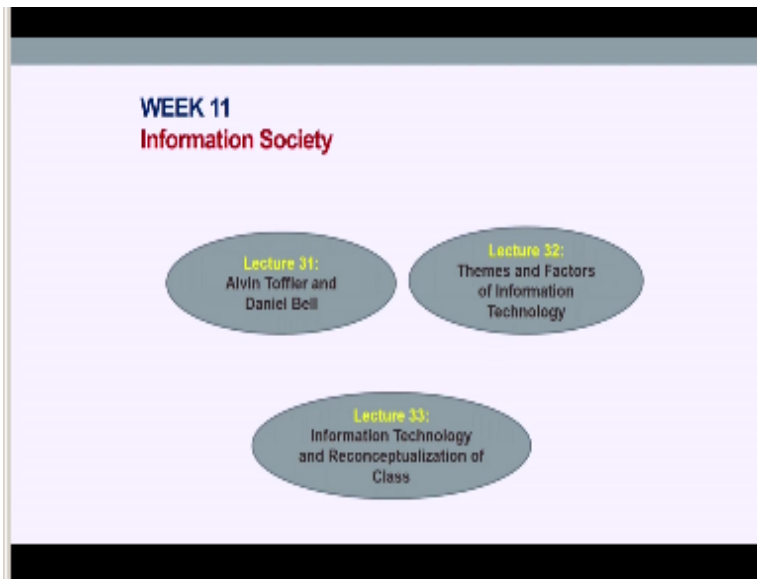
Is very important or very important on important so far as the social shaping of technology is concerned then we have also discussed the case of the smarter a smart house that is a gendered

socio-technical construction okay I mean how innovation can be generated can be a gendered process how the smart house can be a gendered socio-technical construction what kind of household activities are the new artifacts or appliances meant for and what material appliances are in the making okay we have also discussed smart house prototypes the honey well hulls.

The NHF HBO's a smart house John or do and so on and what do designers have in mind okay designers often keep energy safety communication entertainment environment and so on in mind while going ahead with smart house construction but what is the house for house work okay house or perhaps is out of sight and out of mind when we talk about technology that is why it is very important to discuss social setting of Technology women as a social group as though they are relevant to their the socially relevant group.

But they remain absent in the construction of this okay next why the smart house is often considered a masculine construct that is why we have already discussed the declared there must I mean that one-size-fits-all paradigm must go and we have also discussed a history of contraceptive technologies the institutionalization of women as the other there is just that much there is a shift in focus from similarities to differences the institutionalization of women as the other I mean the development of the first physiological means of contraception now focused exclusively on women and whether we have to look whether we have to modify technology to fit people or we have to modify people to fit technology okay the this is what we want to interrogate that we must be able to modify technology to fit or people fit our culture.

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Okay in then we moved on to the 11th week okay on information society we witness many emerging technologies today may be in the form of information technology may be in the form of biotechnology may be in the form of nanotechnology and so on but for our for this course we have restricted our discussion to only information technology okay in the 11th week I mean in the in the 31st lecture in the 32nd lecture in the 33rd lecture we have discussed information society as propounded by Alvin Toffler Daniel Bell.

And what are the themes and factors of information technology and then information technology and the end and how class can be the or the Marxist notion of class may be rejected reasserted and re conceptualized okay in Toffler we have discussed the third wave I mean the first wave is characterized by the cultural societies of second wave is characterized by industrial society and the third wave is characterized by the information society okay then what are the six grounding principles of the third wave or Toffler's third wave that we have discussed there is standardization specializes.

And synchronizes and maximizes and concentration and centralizes okay well we have also discussed Daniel Belle's reflection on the information society in the context of post-industrial

society what is there - what is that post-industrial society or post-industrial society is one where knowledge has displaced property as the central preoccupation and the prime source of power and social dynamic a post-industrial society is one where technicians and professionals are the preeminent social groups a post-industrial eyes a post-industrial society is one where service industries are more important than manufacturing.

And we have we have discussed the shift from post-industrial society to information society I mean the centrality of theoretical knowledge rise to prominence of professional scientific and technical groups a new social framework based on telecommunications information is being treated as a commodity knowledge and information supplant labor and capital as the central variables of the economy and the end of the industrial capitalist era and the arrival of a servicer or laser society.

Okay how information technology is related to social change I mean what David liked suggested that information technology shortens diminishes our labor time it diminishes product products and worker IT the replaces labor as the source of added value in the national product the way knowledge is created and retrieved okay I mean knowledge is being treated as a commodity commoditization of knowledge okay nature of work and occupation and in the 32nd lecture we have discussed the themes.

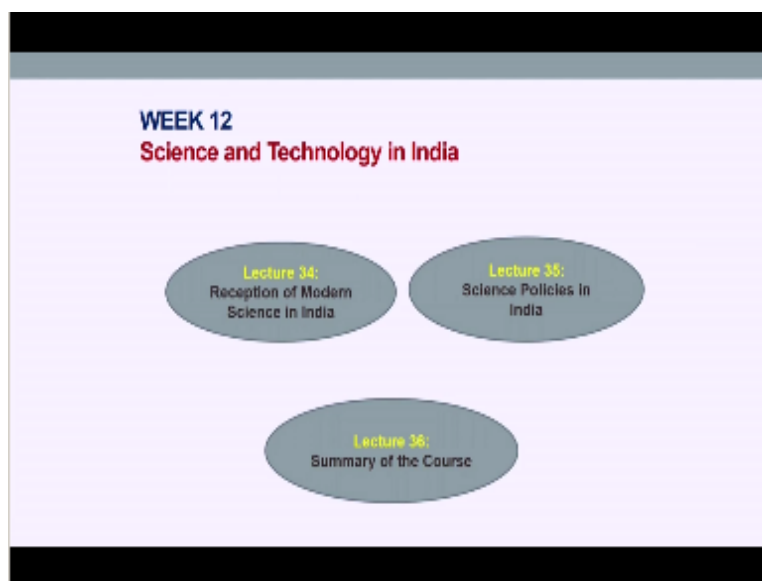
And factors of information technology what the themes of information technology support okay I mean information workers in an information economy political and global respects and an information culture what are the factors which influence information technology I mean military factor the commercial factor and government factor okay we have discussions in the 33rd lecture we have discussed new economy new classes I mean how information technology has been able to compel us to reach to relook at or re-examine Marx's notion of class what David line argues that in the context of the emergence of information technology marches notion of class is subject to rejection.

And reconceptualize okay I mean when we say a rejection of class Marxist notion of class I mean new technology hold so for hope of abandoning class I mean class lists nests achieved by

technical not social revolution when we say reaction of class information technology merely stand-ins the hands of the already powerful capitalist class giving it a wider global scope and tools of tools for tighter social control when we say very generally there is a need to reconceptualize class Marx's notion of class.

They I mean it does it mean that Marx is outdated no does it imply that no classes are disappearing on the I mean why there is a need to reconceptualize not sense notion of class in the context of the emergence of information society is precisely because of the introduction of the fact that the introduction of new technology tilts the balance of power in different ways realigning classes and releasing new social movements okay and we also provided critic to the information society I mean who wields power inequalities conflicts and underlying contradictions and in the context of dominant ideologies okay.

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And in the last week in the twelfth week we have discussed science and technology in India okay in the 34th lecture we have discussed reception of modern science in India okay I mean the process of democratization of scientific knowledge in the Union context institutionalization of

modern science in colonial India policies of colonial rulers and limitations reception of modern science in colonial India.

And when we say how modern science was received in India or how science was Gimmick democratized in India it is by building scientific institutions in 19th century India that we can see okay in terms of the establishment of Hindu College Delhi College the early good scientific society the Bihar scientific society and the Indian Association for the cultivation of science okay we have discussions and we have also mentioned categorically that that the building of such scientific age to you since whatever Delhi College Hindu College Ali good scientific society Bihar scientific society.

The Indian Association for the cultivation of science the building of such scientific institutions by the cultural elite during the colonial period as a part of the process of democratizing scientific knowledge rather than I mean more so democratic senators okay and such institutions I mean science in India was each teachers analyzed and democratized not because of the colonial government but in spite of the colonial government democratization of science in India as you have discussed is an unfinished task even now such modern science is being critiqued from the point of view of environment.

And human rights democratization maybe each teacher in the process of science policy making that should be a broad-based democratic transparent and participatory process and in the and when we look at the post-colonial science in India we must reflect on science policies in India okay that must be a transition from colonial to post-colonial period okay in science policies in India we have discussed chiefly for policies scientific policy resolution of 1958 technology policy statement of 1983 science and technology policy of 2003.

And science technology and innovation policy of 2030 while dealing with science and technology policy of 2003 and science technology and innovation policy of 2013 it is important to discuss the, the context of intellectual property rights regime it is important to discuss the patents trademark which we have discussed and the 36th lecture I mean this lecture we provided a summary of the course I am sure all of you will have a fruitful experience we will enjoy this

experience you will, will have a fruitful useful experience with this course if any question is if there is any question in your mind any query in your mind.

And you doubt in your mind if any disagreement in your mind you can post them on the NPTEL moon portal okay I hope we will have and you will also appear in the test there will be assignments there will be and semester exam minutes and final examination I hope everybody performs very well in the course in the examination it is not simply examination if you understand this course then the ended purpose of delivering such lectures will be fruitful and I hope everybody performs very well in the course and in life I said thank you.

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