Symbolic Logic
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Lecture - 01
Introduction:
What Logic is
Kinds of Logic
Western and Indian Logic

Hello, welcome to the NOC course on symbolic logic. We are going to do this for 20 hours.

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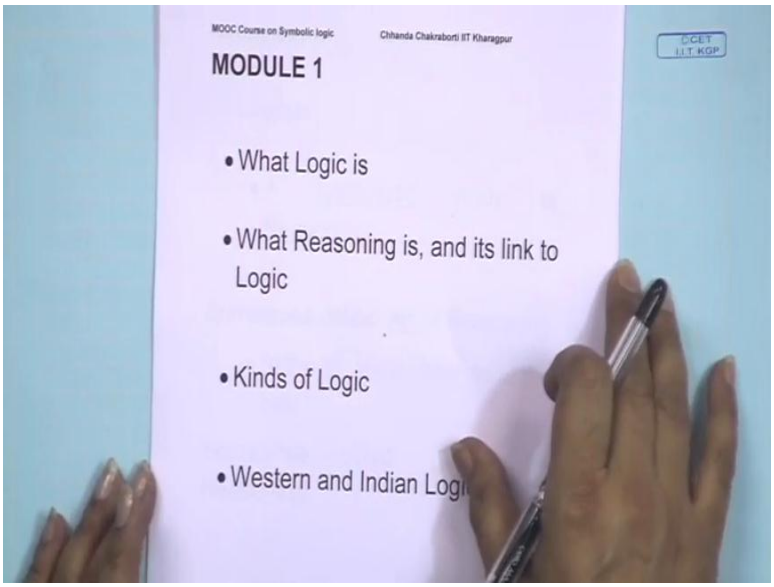

Today, we are starting with the module 1. In module 1, I introduce you to What Logic is and then I will define it as a study of reasoning and then we will go into talk about what reasoning is what is its link with logic and what are the basic kinds of logic and then this distinction between Western and Indian logic. So, this is the plan that we will follow in this module.

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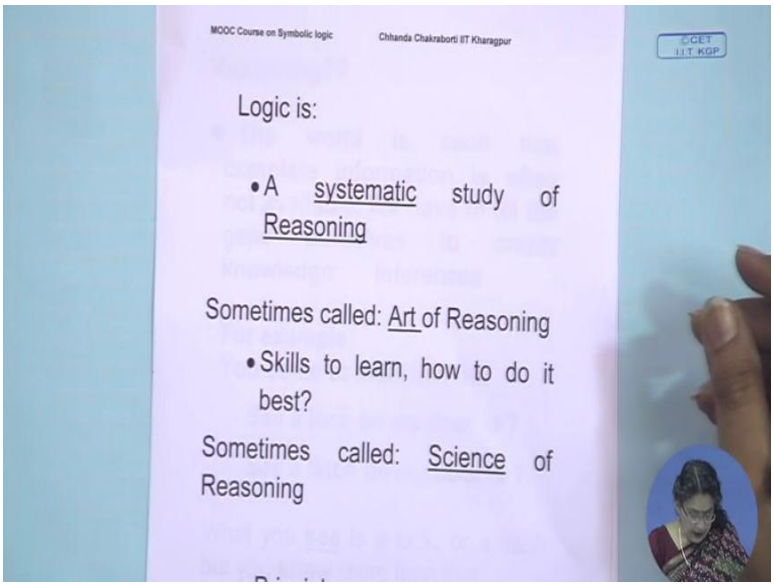

A simple definition of logic is that it is a systematic study of reasoning and I must tell you that though the name of the course is symbolic logic, but it is beginning classes, some few lectures that we will hold, may be four or five. We are going to do it rather in formally without use of any symbol so that an introductory or a beginning student can understand it better. So, we are going to switch to symbols from perhaps after sixth or seventh lecture but let us start with where we were namely that logic is a study, first of all it is a discipline and that it is a systematic kind of a study which means there are principles and that is organized, but the content of logic and if you asked what this logic is a study about or on then we have to say it is about reasoning. Sometimes, it is called an art of reasoning and I hope you know the difference between the Art and Science but the Art requires some sort of skill. So, when we are talking about logic as an art of reasoning, we are talking about there are skills to learn that there are ways to think about how to do reasoning best.

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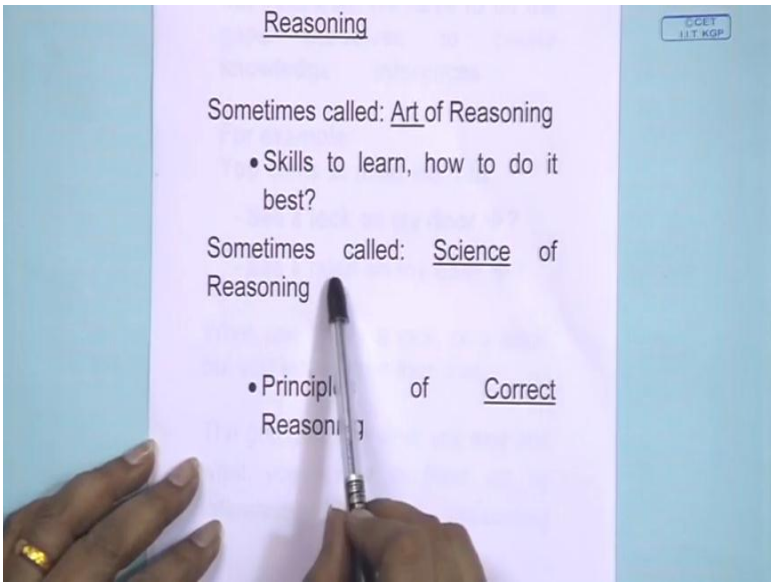

Then sometimes it is also called the Science of Reasoning. When we want to talk about a Science, we mean that there is a systematic body of knowledge here and there is also principles behind that. In case of logic, these principles would be the principles of correct reasoning. The moment I say that it should forgive that there are also incorrect ways of reasoning but logic will try to teach you the ways of correct reasoning and there are justifications and principles which will guide us how to make reasoning correctly.

So, what I have done is to define it in other simple way that first of all logic is a systematic study of reasoning and I have also told you what the topic or the content of logic is namely about reasoning. There are two kinds of approaches to logic that you can think about as a skill development which is also good, but you can also think about as a basic science which speaks about formalizing and organizing the area or the studies with some preparing fundamental principles, but first let us talk about what reasoning is. We have use the word reasoning but I am yet to sort of come to a clear definition about it.

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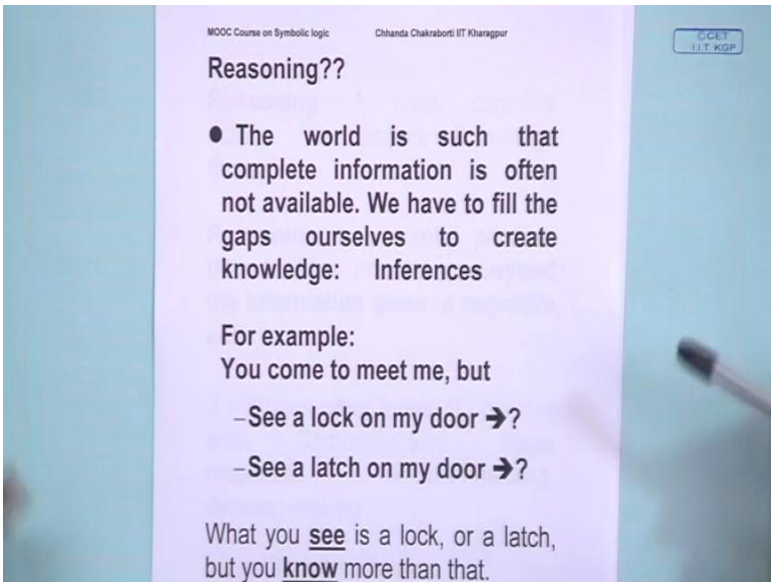

So, let us see what is Reasoning? We learn in many different ways, we learn through our senses and we have five senses the eyes, the ear, the skin and so on but then there is also another way to learn or gather knowledge and that is reasoning and why do we need reasoning? The answer is quite clear because the world is such that always complete information is not available to us and when that happens what we do is that we fill up those gaps where information is not available with a different kind of cognitive process and that is where you will find what reasoning is. Let me give you one example to explain this for example, suppose you come to IIT, Kharagpur and you come to meet me and instead of seeing me you find that there is a lock on my door. What do your eyes see? The answer is you see a lock but if I ask you what do you know? Your answer is going to be quite different. You will say that I know you are not in there, would you wait for me? The answer is probably not.

Now, let us change the scenario a little bit. Suppose again you come to meet me, but this time you see a latch on my door. Again, your eyes pick up the information that there is latch on my door, but if I ask you what you know, the answer is not that there is a latch on my door, the answer is much more than that.

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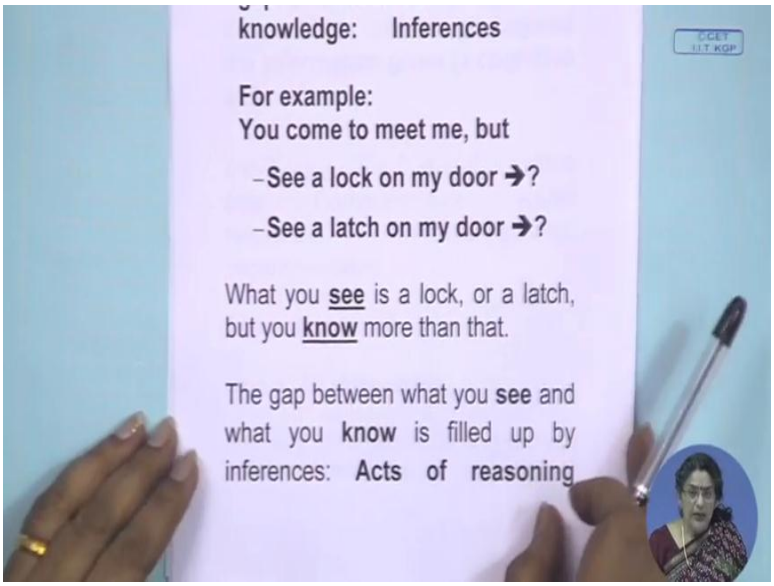

What you know is probably I am somewhere, would you wait for me? The answer is yes. The knowledge affects the kind of behavior that you do but please note that the knowledge is not a clearly given knowledge. So, it is not a direct knowledge that you have obtained. You saw something but you know something and that gap between what you saw and what you know has been filled up by this cognitive process that we call reasoning. So, the acts of reasoning are to be found in this kind of gaps and these are very interesting kinds of acts and this is what we will called reasoning.

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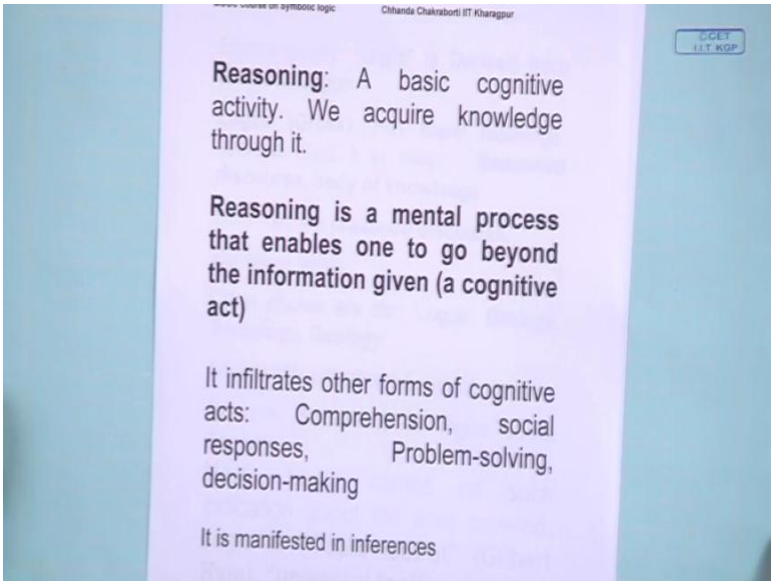

Human reasoning is a very basic kind of cognitive activity. We throughout our lives and also through generations and if you believe in evolution then biologically we can show that we acquire knowledge and we have been acquiring knowledge through reasoning for years. It is a mental process that keeps on going. You look at all the censoring input and then you add something more to gain more knowledge out of the situation. So, in a way reasoning first of all, please note that it is mental process and it happen somewhere in your mind and what it does? It enables you to go beyond what is given through your sensor inputs and that is a very important activity, otherwise we would be very limited in our knowledge.

We can show you many situations where you are making quick decisions based on reasoning. For example, think about crossing a very busy intersection, your eyes are picking up fast moving cars, the images of them and your ears are picking up the sound signals but mentally what your doing is very quick reasoning and calculation of where to go, how to cross the street without getting hurt. Now, this is a very complex reasoning example, but there can be very simpler also then what I am trying to tell you is that reasoning is a fundamental kind of cognitive activity.

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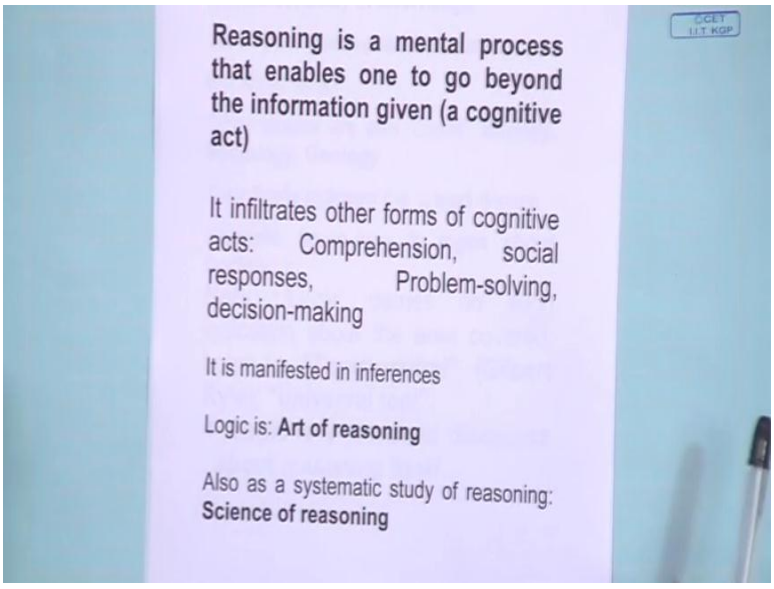

It actually shows up in other forms of cognitive activity for example, when you understand something. What you are reading are words but then from that you are making meaning and that meaning making has to be done on the basis of reasoning.

Similarly, social response is that you see somebody sitting or you see somebody weaving at you and then what is the appropriate social response. We are quickly going through the reasoning to get that appropriate responses out and the most manifested example of reasoning application would be problem solving. So, I am trying to show you when I said that the subject matter of logic is reasoning, this is your acquaintance with the process that logic sort of tries to understand, tries to formalize, tries to talk about correct ways of doing and that is a very fundamental kind of cognitive activity.

So, I will repeat what I have said earlier that logic in a way is both an art of reasoning and how to do this reasoning in a better sort of way and it is also a science of reasoning in the sense that there is a normative angle mainly telling us how to do it correctly or how to do it not just better but how to do it properly. There are two ways to look at logic.

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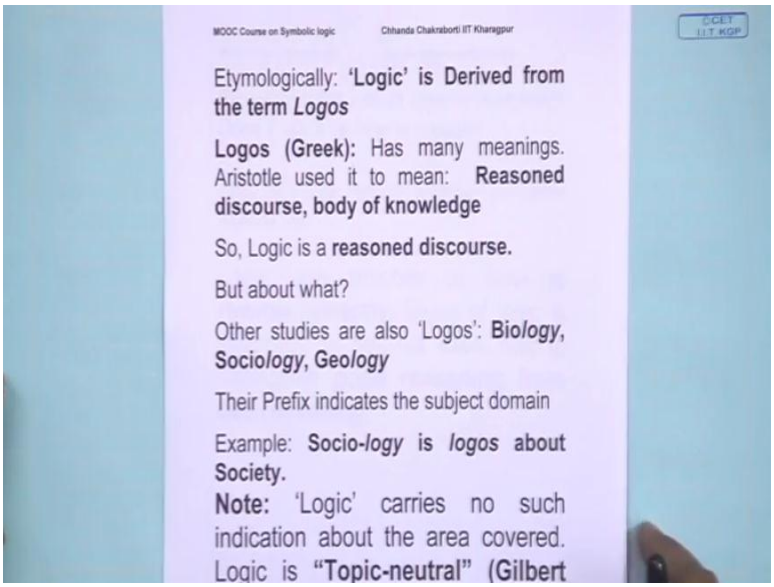

Now, that was our quick introduction to the content of logic, but let us come to the study itself. Now, I always thought that one way to learn about things is to go to what we say is etymology and etymology means where the route of the word is and if you look at the route of the word logic then it is in a Greek word called Logos. You may have heard this term logos earlier. It has come from Greek language. Logos has many meanings actually many meanings in Greek and there are various kind of applications, but will follow what Aristotle used it as. Aristotle used logos to mean some sort of a reasoned discourse. So, it

is a body of knowledge that is not half as it and it is guided by reasoning. So, in that sense we will try to remember this word Logos.

Then, I have told you since etymology sort of give you a hint of what the study is like since logic is derived from the word logos. It is also reasoned discourse but what is the content of this? I have told you that is reasoning but let us try this. Wherever we see this term Logos as in logic, you get a see a reference to a study. For example, you may have heard this disciplines Biology, Sociology, Geology and I would like to point to the presence of logos in this square here. This is logic which comes from the Greek word logos. So, here are logos of bio, this is logos of socio and this is logos of geo. What happens is that there is a prefix to the logos and that tells us what the logos is about or the reason discourse is about.

For example, here the prefix is bio which means that it is the reasoned discourse about the living or the sphere of life bios. This is about society and this is about geo or earth. In comparison with when we look into logic, there is no reference to the subject domain and there is no prefix just logos, derived word logic and there is no indication about which area this is going to cover. There is a cue in that or clue in that and the absence of the prefix in a way sort of tells us that it is a topic neutral study what Gilbert Ryle, a philosopher said, it is a topic neutral study and it means that it does not matter where you are applying logic. It will be a tool and this is the reason why often like mathematics logic is called universal tool.

No matter which subject domain you are applying it to, it will give you some help. So, in a way what we have just found out is that first of all being a kind of logos, logic is a reasoned discourse, but what is its content, its reasoning and please note that we are trying to understand reasoning and we are making a discourse based on reasoning and we have to use as a tool also as our reasoning. So, there is a self referential sort of a loop in logic which is unavoidable because that is the only way to do it, but that is what the nature of this study is. In a way it is kind of a rather abstract, but at the same time it is immensely applicable in no matter what kind of study that you are looking into.

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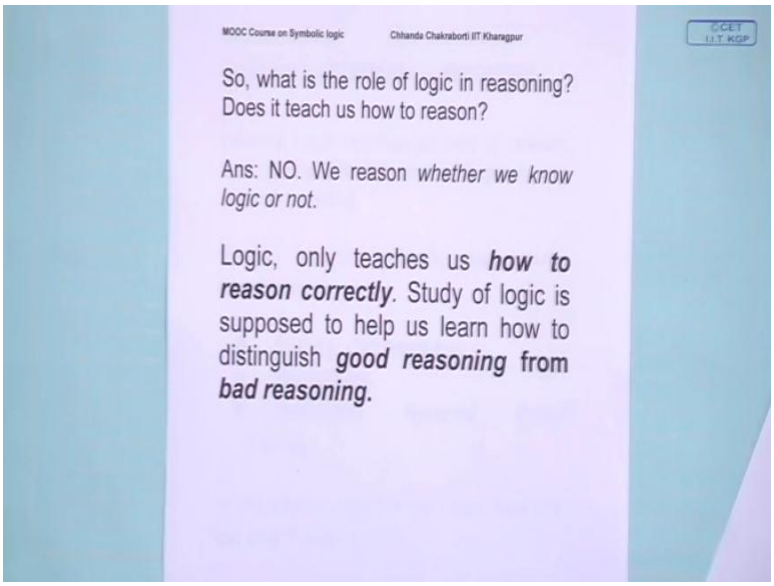

Now, I have said so far that this logic teaches us guides as in reasoning and so on, but still let us make this question very clear and if you now ask me then what is the role of logic in reasoning, does it actually teach us how to reason? I have to tell you then no it does not because that is what you have already I equipped with. Your brain has equipped you and your survival so far has equipped you how to reason otherwise you would not be surviving. So, in order to survival life you do not have to sit in a class of logic and before that you already know how to reason, then what is it that logic does and what it does is to teach you how to do that reasoning correctly.

As I told you there are more than one ways to do reasoning, you can do reasoning because remember reasoning is always a jump and there is a gap between what you actually get the information on and what you are trying to infer from it or what you are trying to know from it. So, there is a gap and as because of the precarious or dangerous nature of this gap. There is chance that you might go into wrong way. What logic does as a systematic study? So, sort of guide you how to do this reasoning correctly and in a way it gives to criteria of how to differentiate good reasoning from bad reasoning. So, it is not a matter of opinion that you called some of certain kinds of reasoning good and certain kinds of reasoning bad. There are ways to justify those and those are the principles that we are going to learn. This is the role that logic plays.

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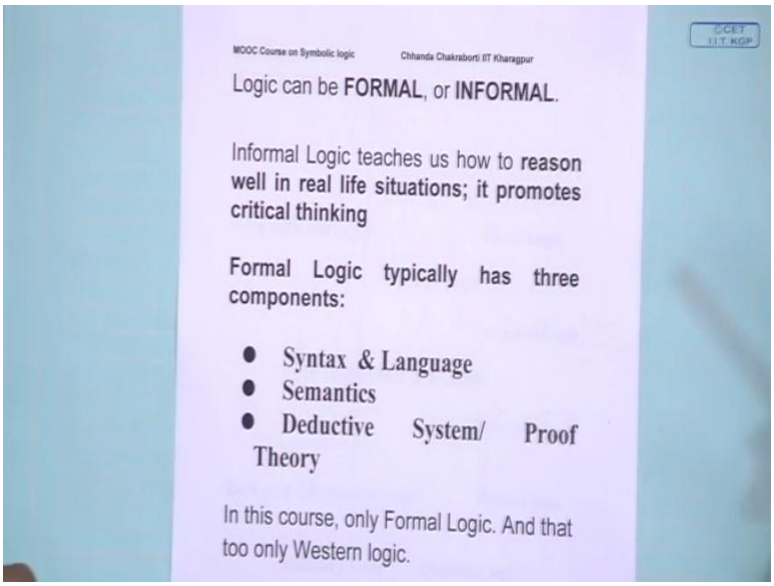

Broadly, logic can be of two types which we call Formal and Informal Logic. In other context, I also teach informal logic, but this is not a class on informal logic, but let me just acquaint you or at least give you as an idea what informal logic does and see always the questions of logic or where you can apply logic, it does not come always neatly in mathematical terms or in quantity terms or in symbolic terms where you can formalize and apply this kind of logic, but often in real life situations there are questions to be answered and those are logical puzzles. So, in a way you are going to help from informal logic because it teaches that how to reason well in real life situations and how to apply critical thinking. You know this is an important sort of a skill that informal logic teaches on.

On the other hand, formal logic is something else. So, we are going to do more of formal logic and we are not going to touch informal logic in this course. This is what logic is according to formal logic and there was going to be typically three components in it the syntax, the semantics and a deductive system or a proof theory. So, these are the basic components that a formal logic will have and we are going to go through these components when we start the symbolic logic properly. In this course as I said, we are only going to look into formal logic and that too the western logic. When I say western logic you might seem surprise that why I mentioned western logic. The reason I said this is because India has also a reach tradition of logic that we call Indian logic.

Unfortunately, we will not have a course on that, but let me just at least give you an over view of what I am talking about.

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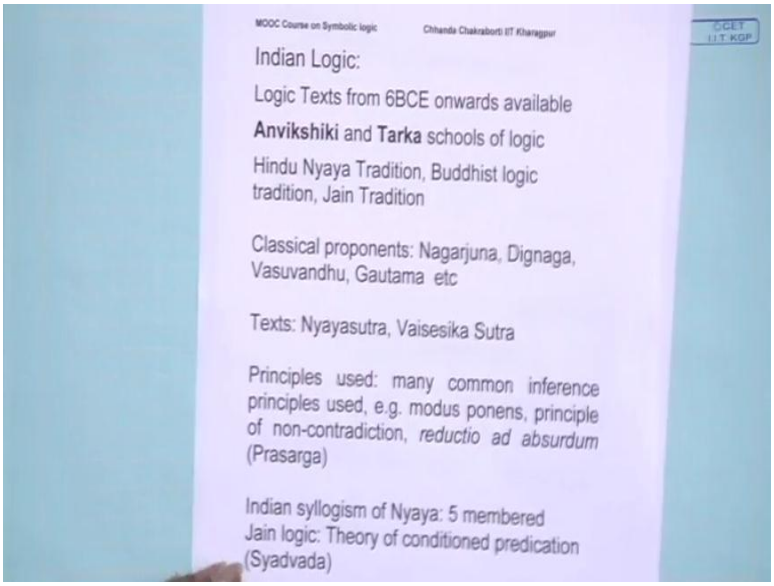

Indian logic when we talked about that there are ancient logic texts available from say 6th century BCE and there were two kinds of major schools of logic. One was called Anvikshiki and other was called Tarka and the goals of these two schools were quite different, Anvikshiki was for sticking out the truth and the Tarka was the about public debate skills as you know that in those days, the scholars, the pandits would have a proper open public debate where they are supposed to argue with each other and the winner was decided by the weight of the merit of the arguments and so on and it carried lot of rewards and titles and so on.

The Tarka school was about the rhetoric and about the public speaking. Anvikshiki was more of a fundamental survey enquiry and if you want to know which schools are those then you can look among the Hindu schools where there was Nyaya tradition which is known for its logic. The Buddhist logic tradition is extremely strong and the Jains also have a very different kind of logic and a very interesting kind of a logic system. The classical proponent's names and some of these names you may have heard for example, Nagarjuna, Dignaga, Vasuvandhu, Gautama etc. When Nalanda was a university, people used to come and learn under this master said Nalanda.

So, there are well known texts of Indian logic Nyayasutra, Vaisesika sutra for example and if you want you can always read upon this because there are some translated texts also available. There have been also a newer developments in Indian logic, this is called Navya-Nyaya which means Neo-logic, neo kind of Indian logic which has been quite popular for example, West Bengal side it had his routes and it also went to Banaras and then I know personally a computational linguistic group or machine translation groups which have taken help from this kind of neo logic of Indian logic, but we are into western formal logics.

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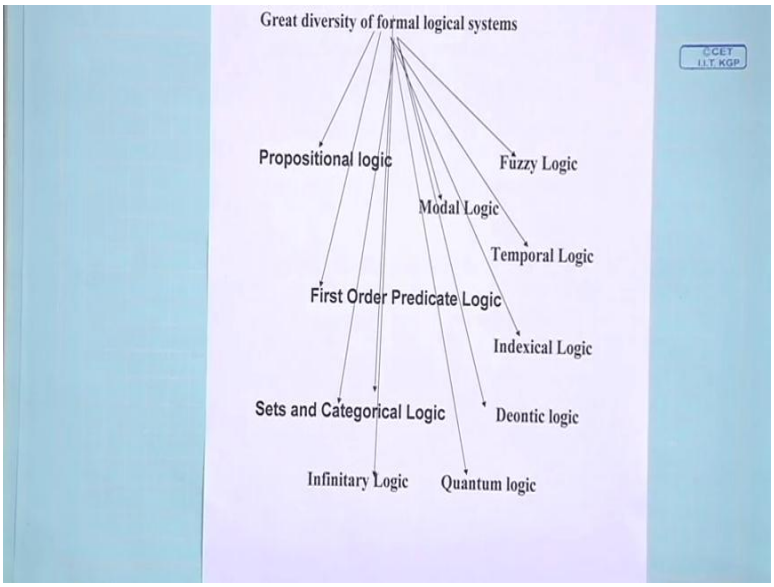

So, I will end this module with this kind of a introduction that there are many kinds of formal logic systems and this is not to give you a proper or a complete picture, but this is just to show you that there are many kind of logics. First, this is something that you must go away from this course that there are different kinds of logics because of necessity and wherever we have needed to logics has been discovered or devised. For example, there is this propositional logic and there is first order predicate logic. There are sets and categorical logic and this three actually constitute what we would call the classical standard logic and this is what we will do in this course, but look at the other varieties that are there. Some of you may have heard about the Fuzzy logic, the basic assumptions of fuzzy logic do not match with the standard classical logic. One example might settle your doubt that the standard logic sort of believe in only two kind of truth values, truth

and falsity whereas fuzzy logic does not and fuzzy logic believes that there are many more intervals in between.

So, accordingly the logic changes, the necessity is such that there are different kinds of logic. This for example, is temporal logic which uses time as a factor. Suppose you want to talk about an operation that has to happen after something or before that. So, that kind of time references doing logic with that time reference is what you will find in the temporal logic. This is just to show you that there are various kinds of logics but we will be concentrating on propositional logic and then we will move towards first order predicate logic but would make a detour through categorical logic which is nothing but a sought of brief introduction to Aristotelian kind of logic. So, this is our introduction to this and with that I will end the module number 1.