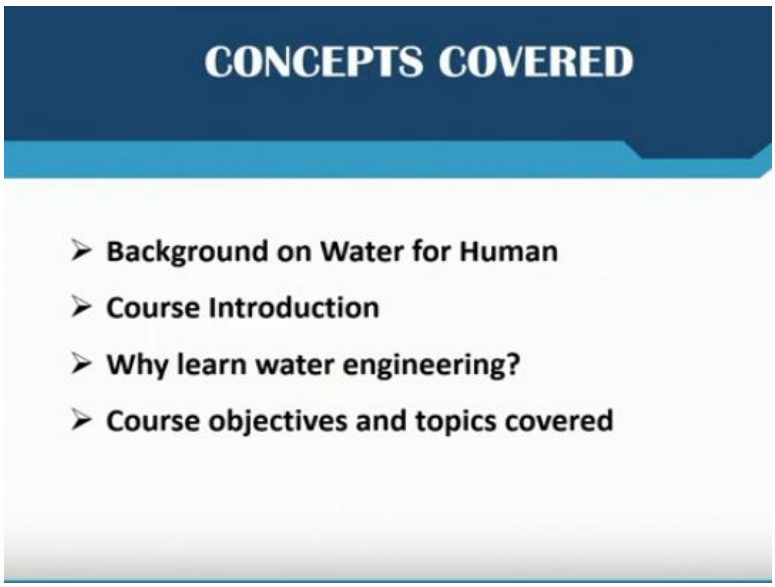
Water Supply Engineering
Prof. Manoj Kumar Tiwari
School of Water Resources
Indian Institute of Technology-Kharagpur

Lecture - 01
Background and Course Introduction

Namashkar friends. Welcome to this inaugural lecture for the course Water Supply Engineering. This is a course where we will be discussing about various aspect and various domains of water supply systems and more so, are dedicated to the domestic water supply or municipal water supply what we call.

Since this is the first lecture so we will begin with the introducing the course and in this very first lecture we will be discussing some aspects related to the importance of water for our life and then what is the motivation behind this course and what are we going to study over the next 12 weeks.

(Refer Slide Time: 01:00)



So, this lecture which is basically on the background of the course introduction what we will be going to discuss in this is background on water for human. Then as we said, why we learn water engineering and what are the various topics that will be covered in this course.

(Refer Slide Time: 01:10)

So we all essentially realize the importance of water in our life, okay? Whether we follow any civilization, okay we very well understand that the water is one of the most integral component of our life, okay. It is basically fundamental to life, livelihood and sustainable development. So, like if you see, for our survival, we need water, air and food, okay?

Of these three constituents or of these three components which is essential for survival of human beings, it is probably air is virtually the most important one, okay because if you do not get an air to breathe one cannot survive even for a couple of minutes. But, the same time, air is something which is available everywhere by nature, it cannot be like prevented or stopped.

No one is going to create a vacuum and put someone into that so that he strive for air. The point is that the air although it is probably the most vital component, but it is available everywhere. There might be issues related to fresh air or a little pollution in the air, but at least it is available for breathing purpose. Now, then comes water and food. So one can easily survive for a couple of days or that way for food but it becomes very difficult to survive without water say for 2, 3, 4 days okay.

And water unlike air is not a component which is available everywhere. It might be available. We may have say groundwater everywhere if we dig deeper, but we cannot, it is not that easy to get that water okay. So, in order to get hold of usable water, we have to set up a system to make that water available to the consumer or to the,

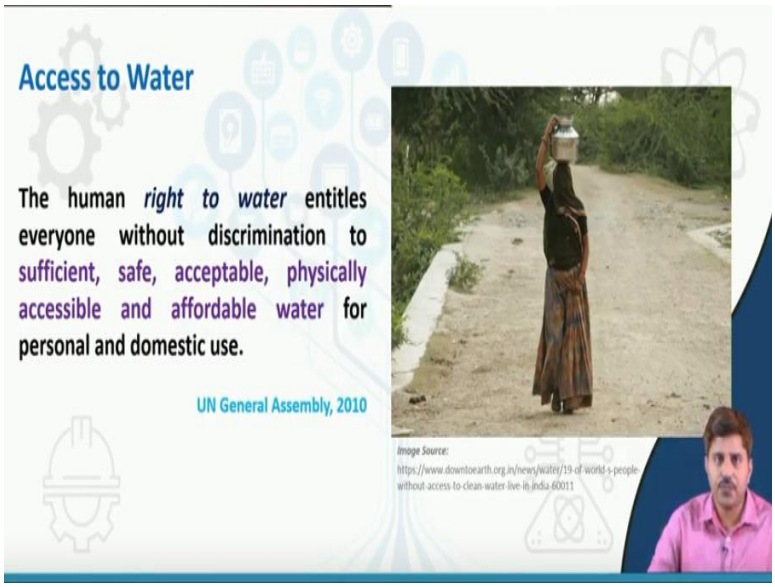
particularly we will be more focusing on human being, so it is essential to set up a system to make that water available for the end consumers, okay.

Water might be available in river, in ponds, in groundwater or in atmosphere, but someone say walking in a dry area, it is not easily accessible to him, okay. So, there has to be mechanism involved for making that water available to consumer which will involve several steps that will probably have, you have to withdraw water from the source or take water from the source. Then you will have to transport that water.

If the quality is not good which is there in the most cases the water quality is not particularly in water resources in India we do not get the water quality which is directly drinkable, okay. We do not usually get the potable water quality. So if the quality is not good, so we need certain processing to make that water to the potable or usable standards, and then we transport that water again to the consumer's tap, okay.

So this all aspect combinely is basically the basis for a water distribution or water supply system. And that is what basically we will be discussing in this course.

(Refer Slide Time: 04:43)



So, if we look at the concept of access to the water, so in 2010, United Nations in its general assembly for the first time accepted the right to water as a basic human right, okay. There has been earlier, judicial precedence's where water has been recognized as an essential component for survival. So, there was like in India also we do not have a separate right to water.

But under right to life, the our judiciary has given several proceedings on that, that right to water is basically a inherent component of the right to life, because one cannot expect a life without access to water, okay. So that way but in any way in United Nations General Assembly, the right to water was considered as a separate human right, basic human right.

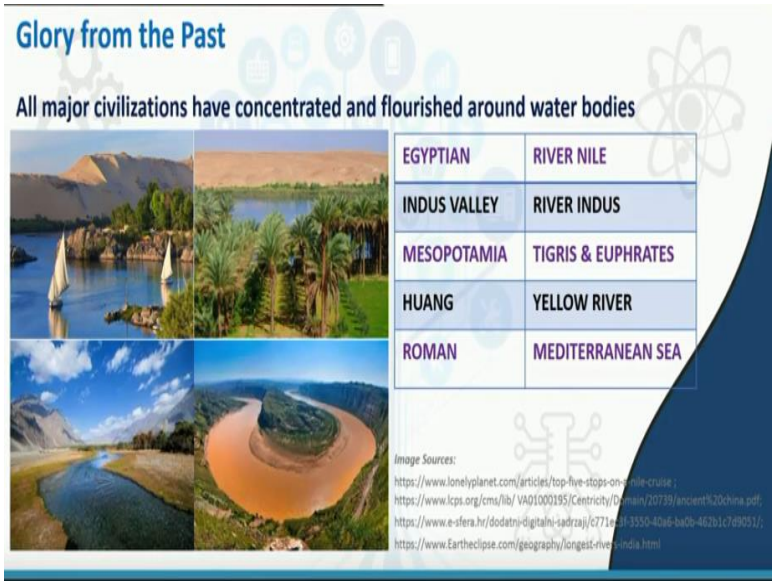
And which entitles everyone without discrimination, without basically gender bias, without any rational bias or without any discrimination it entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water. So the water has to be in sufficient quantity. Water has to be safe in quality, okay so there should not be any harmful constituents.

Water has to be in acceptable form, means even if say it is chemically safe but it is causing color and those things so that water no one will accept for domestic consumption or domestic uses. So it has to be of acceptable quality. Then it has to be physically accessible, means it is not that we say okay, we are providing you water but you will have to travel 5 kilometres to fetch that water.

So that is not like ideal case of making water accessible, okay. It has to be accessible within reasonable distance, okay. So it has to be physically accessible and it has to be affordable in cost. So there is a misconception that right to water entitles everyone for free water but that is not the case. Right to water says that everyone is supposed to get water but at affordable prices.

It does not say free and affordable prices were defined as 3% of the monthly household income. So one can spend 3% of their monthly income to the water. So that is what basic criteria was kept for affordable water. So it should be available for that purpose for personal as well as domestic uses. So that was right to water, okay.

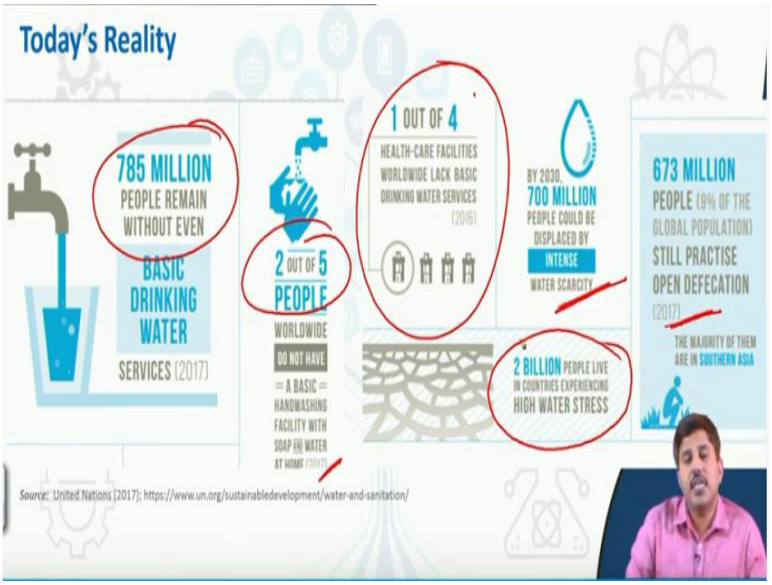
(Refer Slide Time: 07:37)



Now, if you see our all the ancient civilization or the major civilization that we have in the past have mostly been flourished in and around water bodies, okay. We have the Egyptian civilization on River Nile. Then Mesopotamia, River Tigris. Then Roman, again towards Mediterranean Seas. Indus Valley Civilization is beside River Indus.

So, because even in the ancient times it was realized very well that the water is essential for not only survival, but for sustainable development also because water was a means for transportation, water was means for earning sort of living for large group of people. So, that was kind of importance which were given to the water.

(Refer Slide Time: 08:29)



Now, if we see in today's time, although as we were just discussing that in ancient civilization, we have those kind of development but the water quality or availability of water was not in criteria back then because less number of people and more easily accessible water, the more civilization was towards the water body, so it was available at easy terms and not much crisis was there.

But with the modern development and the kind of modern development that is taking place, the industrial growth, the urbanization, the population shoot up, so all these in combination actually bringing several issues. So if we see this is actually what you see on the screen are some of the data from United Nations, some number, facts and figures from the United Nations, okay.

So if you see, the United Nation says that around 785 million people remain without even basic drinking water facility, okay basic drinking water services. That is a huge number, okay. The United Nations believes that two out of five people worldwide do not have a basic hand washing facility with soap and water at home, okay. So only like two out of five means 40% of people are devoid of these a basic hand washing facility at their home, okay. One out of four have like healthcare facilities if you see.

So they lack the basic health care facilities related to the drinking water, this thing, right. So that is some of the numbers. Similarly, like it is expected by 2030 700 million people could be displaced by intense water scarcity, okay, 700 million people, okay. Another data suggest that 673 million people which is 9% of the global population still practices open defecation. So, this is more on the sanitation aspect though, okay.

Overall around 2 billion people live in the countries that are experiencing high water stress, okay. So, these are some of the kind of figures which emphasizes the importance and need of looking the water from different perspective or say highlight the requirement for the basic management or moresoever like more effective management and services in terms of water.

(Refer Slide Time: 11:32)

If we look at the major challenges there, so we have challenges related to water availability and quantity, okay. So how much water is available? How much water is available, in what quantity it is available? We have issues related to water quality, okay. What is the quality of water? This is actually one of the prime challenges these days. Earlier, the quality was neglected part because people who are more concerned about getting the water first, fetching the water first.

And people who are mostly relying on to the groundwater services or those kind of things and river also used to carry good quality of water. But with lot of industrialization, lot of development, urbanization, you know that the state of the rivers in most of the developing world has deteriorated badly. And as a result, the quality at the resources, surface water resources as well as groundwater resources are not that great anymore, okay.

So it does not like it is not no more suitable to consume water directly from the source. So the quality is one major challenge that we need to look at the quality aspect as well. Then population, the growing population will actually ask for more water. So, demand that inversely like relates to the quantity aspect as well. There is a industrial growth and urbanization.

So, we have more industries and that again require more amount of water. So, those kind of issues come into the picture. Then there are climate change related issues, okay. Now, climate change is another hot topic where which is actually affecting

water resources in an enormous way. There are more intense rainfall, more frequent rainfall or not frequent you can say but more like it is more concentrated in some period. So, overall rainfall might be less but it is more concentrated.

So we are getting lot of floods. For long period there is a dry phase, so lot of drought, flood. Then, more because of global warming more evaporation losses are taking place. So there is lot of issues related to climate change and we need to adapt to the climate change or the changing climate which is actually affecting water resources. So we will have to think of a way to manage our water services or water resources, neglecting or reducing or minimizing the impact of the climate change on these.

Then another and probably one of the most prominent issues is water management and governance. Now water management and governance because whatever water we have, that also is not efficiently managed. We will discuss these issues in more detail in the later weeks. But the just to give you an idea that in urban water services, if you are withdrawing hundred units of water, only maybe 50, 60 units of water reaches consumer ends and rest 40, 50% water might get lost somewhere.

So, that is the huge amount of water losses is just an example of improper water management. Then there are issues related to governance, because there are water requirement from different sectors. There are water requirement from industries, agriculture, domestic sector and there is a natural requirement of water itself. You need your rivers to carry water.

So you cannot withdraw all the water from a river, okay. So you have to maintain the base flow in the reverse also. So there is an environmental requirement as well for the water. Now, because there is a demand from different sectors, so there has to be a good governance practice to allocate water to the different sectors and to oversee that water is judiciously and equitably distributed within the sector also.

Like in domestic sector if you allocate certain water we have cases where in a same city let us take an example of Delhi. So, some section of Delhi is like is getting a water say around 300, 350 liters per day per person, while other sections of Delhi is

just getting water 50, 60 liters per person per day. So that kind of an unequitable distribution is there, which is another example of probably poor governance.

So, we will have to look at the aspects of water management and governance and there are many more such like challenges which we have to look.

(Refer Slide Time: 16:35)

So we will be discussing some of these in this course. Now, what can we do to like what role we can play. So, as most of us are basically engineers we will focus more on to the engineering aspect, but otherwise also as a citizen, you have to see that the water is supplied judiciously and is being used judiciously, okay; so equitable distribution and fair distribution and sort of ethical uses of water.

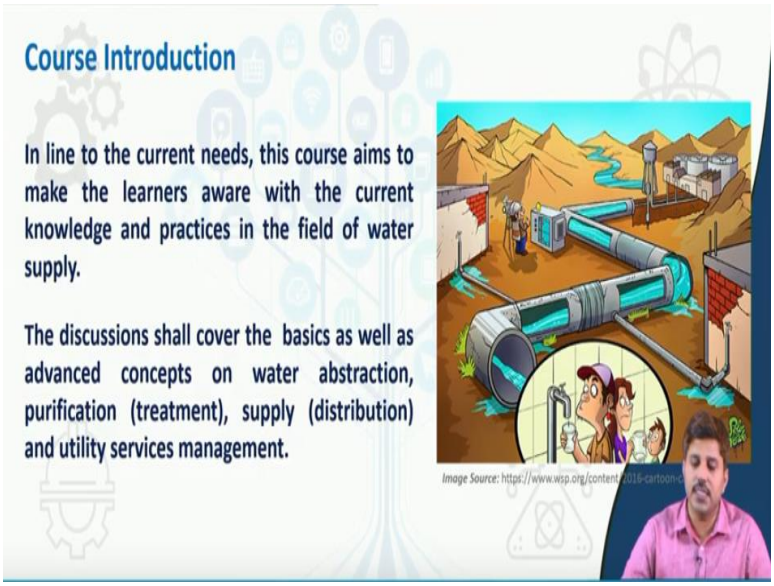
It is not like somebody, if you do not value water somebody is getting lot of water. So, it is spread, it is basically wastage in car washing, gardening, like various other applications are there where water could be wasted, okay. So that needs to be seen. Then protection of resources. As a citizen or as a engineer, we have to see that there are appropriate systems for protecting our water resources.

Of course, as we discussed that there are a lot of management and governance issues. So, there has to be effective and efficient management system for managing water. And the least we can do, we should become a responsible citizen so that we use water as a citizen itself, okay, as a consumer itself, we use water judiciously.

If we are seeing any place water is being used unfair way, unfair through unfair means, we should stop that or at least we should make an attempt to inform the responsible people who can stop that, okay.

As an engineer, we should acquire the awareness and knowledge about the water sources, the sectoral demands, the availability, the supply system and governance as well so that we can equipped ourselves to play a role in the management, maintenance of the water services or different components in a water utility.

(Refer Slide Time: 18:37)



So this has been actually the motivation behind putting up this course, okay. This course will eventually target or if you talk about the basic objectives of this course, so this is in line with the current needs and aims to make the learners aware with the current knowledge and practices in the field of water supply. So mostly we are going to have discussion on to the urban water supply systems or municipal water supply systems.

So, we will have discussion that will cover basics as well as advanced concepts on water abstraction, because when we are talking about water supply, so we have the different components associated with that. We have to withdraw water from a source. So that basically comes under water abstraction. Then we have to purify or treat it. So that will be purification.

Then we have to supply water, distribution and overall utility service management. So what are the practical challenges and issues that come while we go for setup a water utility or a water supply system? So we will talk about some of those challenges issues and how to manage that.

(Refer Slide Time: 19:54)

The specific objectives of this course is to understand the importance of water as a resource, to recognize the beneficial use of treated water in human life as well as economy. Now, beneficial use is a important word here, because we have to see that as we said that there are various competing sectors that imposes water demand. There is agriculture sector, there is industrial sector, there is domestic sector.

So, we have to prioritize the sector okay and judiciously make a decision or recognize that where should this water, this part or this component of water should be allocated. So, those kind of aspect we will try to get an understanding on that.

Then we have to acknowledge the issues and challenges of modern water supply system in the cities as we were just discussing that various infield problems comes when we go for a supply system and particularly in a modern supply system, which shall be equipped with the automated systems with the sensors with the automated control system.

So, in these, like we talk about smart cities these days, so, a smart city should have a smart water supply system as well. So, what are the various aspects or issues that will

come when we go from a conventional system to a smart or modern water supply system. So, we will have a discussion on that as well. Then the idea is to gain knowledge on the available technologies for water treatment.

That is a major component of this course. So, we will be discussing what are the various technologies available for purification of the water. Because purification of water is one or treatment of the water what we call is one of the very important aspect. The water available at resources is probably not fit for uses directly. So, we will have to chemically or whatever means we take, chemically process that water.

So that is done through the treatment technologies and we will have a discussion on that, a detailed discussion rather on that. Then one objective is to grasp the knowledge of the complex water distribution system. So, as we said that we have to talk about abstraction, purification as well as distribution system.

So, when we go to the distribution system, how effectively and economically, economically in terms of cost and as well as in terms of operational energy, we can make the water available to the end consumers. So, that is one of the objectives of this course. Overall, the objective is to be well equipped to handle the issues related to the public water supply systems.

(Refer Slide Time: 22:53)

The what we are going to discuss in this course. So, there are these are some of the prime topics that will be discussed, will be discussed about water availability and

uses. We will be discussing about the generic urban water services. We will be discussing about the issues and challenges. Then water demand, water collection system, treatment philosophy and the treatment steps.

Then water quality aspect, how to improve the quality of water. We will be talking about, in this sense we will be talking about conventional as well as some of the advanced water treatment approaches that are adopted for purification or treatment of the water. We will be talking about the distribution network. Then, as we were just saying, for smarter systems we need automation in water supply.

So we will be talking about those aspect. We will be talking about water losses and control, how to control the losses that are there in the distribution networks. And we will touch upon some of the aspects of water economics and pricing when we go for a urban water supply system.

(Refer Slide Time: 24:00)

So, these are some of the reference books, okay. This there would be many more reference materials that will be sort of used while in the discussion. But these are some of the prominent reference materials and if any specific reference is used in more detail so that will be shared when basically we go on the discussing in the subsequent weeks.

So, with this we thank you, I thank you for joining me in this inaugural lecture. And this was about a generic introduction of the course as you have seen. In next class, we

will be starting the discussion on the first thing that what are the sources and how much water is available for us. So, hope to see you in the next class. Thank you for joining.