DEPARTMENT OF CIVIL ENGINEERING MNNIT, ALLAHABAD

CE-12101 ENVIRONMENT AND CLIMATE CHANGE

Introduction to the Course

Course Introduction:

Lecture No.	Topics
1.	Introduction to the course and Lecture plan Everything which surrounds us may be referred to as the environment and the study which covers different aspects of environment, its structure, functions, its quality and the maintenance of its quality including conservation of its living and non-living constituents can be collectively referred to as "Environmental science" or "Environmental studies". The air, soil, water, all living and non-living things around us constitute the environment, which influences our lives. It is from the environment surrounding us that we get food to eat, water to drink, air to breath and all necessities of our daily lives.
2.	Introduction to Environmental challenges: • Environment Pollution: Air, Water, Soil, Noise • Global Warming and Climate Change • Overpopulation • Natural Resource Depletion • Waste Disposal • Ozone Layer Depletion • Acid Rain • Genetic Engineering
3.	Natural Resources conservation concepts and techniques • Introduction • Renewable and Non-Renewable Resources and present scenario in India • Conservation of Natural Resources

4.	Indian Natural Resource Management Programmes and its objectives • Nationwide programs/Policies to conserve various Natural Resources
5.	Introduction to Sustainable Development • The Concept of 'Sustainable Development • The three pillar Approach • Goals of Sustainable Development
6.	Carrying capacity-based development • Introduction to Carrying Capacity
7.	Clean energy alternatives on various segments • Energy sector • Agriculture sector • Transport sector • Construction sector • Public participation
8.	Case studies on Clean Energy • Various Case studies of clean energy usage in India
9.	Introduction to Climate Change • Introduction and Basics of Climate Change
10.	Cause and Impact Assessment Studies for climate changes • Causes of Climate Change • Greenhouse Gas Effect
11.	Mitigation measures for reversal of climate changes • Role of various sectors to reduce the effects of Climate Change
12.	Technological interventions alternatives and case studies • Various Technological interventions to reduce Climate Change in India
13.	International agenda and treaties for climate changes
14.	Global concerns on Climate Change
15.	Efforts to minimise climate change impact on society
16.	Efforts to minimise climate change impact on society
17.	Social and Environmental Impact assessment • Introduction to EIA and necessity • Stages involved in EIA
18.	International treaties & Global initiatives related to Environment and climate change
19.	International treaties & Global initiatives related to Environment and climate change
20.	Carbon foot print
21.	Introduction to Pollution
22.	Preventive measures to control air water, soil and noise pollution
23.	National or international standards on pollution
24.	Environmental Laws and regulations.

Reference Books:

References:
1. A Basic Course in Environmental Studies. Deswal & Deswal. Pub. Dhanpat Rai & Sons
2. Environmental Studies. Bharucha. Pub. University of Press
3. Environmental Engineering. Peany et.al. Pub. McGraw Hill
4. A Text Book of Environmental Engg. Venugpal Rao. Pub. PHI

INTRODUCTION

As we look around at the area in which we live, we see that our surroundings were originally a natural landscape such as a forest, a river, a mountain, a desert, or a combination of these elements. Most of us live in landscapes that have been heavily modified by human beings, in villages, towns or cities. But even those of us who live in cities get our food supply from surrounding villages and these in turn are dependent on natural landscapes such as forests, grasslands, rivers, seashores, for resources such as water for agriculture, fuel wood, fodder, and fish. Thus, our daily lives are linked with our surroundings and inevitably affects them.

We use water to drink and for other day-to-day activities.

We breathe air,

We use resources from which food is made and

We depend on the community of living plants and animals which form a web of life, of which we are also a part.

Everything around us forms our environment and our lives depend on keeping its vital systems as intact as possible.

The traditional concept, that natural resources are abundant for man to use or abuse, has been responsible for massive degeneration of nature, natural systems, environment and wildlife.

Departing from the traditional perception of human dominance over nature, a more realistic view that man is just a species among millions of species and his well-being is intimately linked to well-being of all other species has now emerged.

Man cannot survive alone and aloof from other living beings. The natural systems in which man exists along with all other species must be maintained in a healthy and functional state.

The science of environment is a multidisciplinary science, which may require attention of experts from different branches of science when decisions regarding environmental matters have to be taken.

Man has long affected his local environment but it is in the 20th century only, particularly in the last fifty years that the scope of his influence has expanded to a global scale.

Today we affect earth systems significantly extracting materials, using energy and emitting pollution in our quest to provide food, shelter and a host of other products for the world's growing population.

Over-exploitation of natural resources and pollution of environment are corroding the vital life support systems on which all life depends for its subsistence.

Through growing more food by using fertilizers and pesticides,

Developing better strains of domestic animals and crops,

Irrigating farmland through mega dams and developing industry, led to rapid economic growth, the ill effects of this type of development, led to environmental degradation.

The industrial development and intensive agriculture that provides the goods for our increasingly consumer oriented society uses up large amounts of natural resources such as water, minerals, petroleum products, wood, etc.

As natural systems degenerate, it will be difficult to maintain productivity of our agriculture and obtain necessities of our day-to-day life. Chemically altered environment shall make our lives more and more difficult.

Nonrenewable resources, such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations

Renewable resources, such as timber and water, are those which can be used but can be regenerated by natural processes such as regrowth or rainfall.

But these too will be depleted if we continue to use them faster than nature can replace them.

For example, if the removal of timber and firewood from a forest is faster than the regrowth and regeneration of trees, it cannot replenish the supply.

And loss of forest cover not only depletes the forest of its resources, such as timber and other non-wood products, but affect our water resources because an intact natural forest acts like a sponge which holds water and releases it slowly. Deforestation leads to floods in the monsoon and dry rivers once the rains are over

Much improvement in environmental quality can be achieved by individual life style decisions or by the action of local bodies.

For example, couples may decide to have only two children and thus help in population control.

Individuals can use energy more efficiently.

They can use a bicycle instead a car thus saving a little petrol. The few drops saved by everyone shall make a huge quantity – a little less Carbon dioxide shall go into the atmospheric air.

The few grains saved by each of us shall add up to make surpluses, which will lower the prices enabling the poorest to afford it.

For issues concerning environment not only attention but also active co-operation of every one, at every level of social organization, scientists, educationists, social scientists, politicians, and administrators is needed.

Movements, which begin at grass-root levels, affect the ideologies and policies of a country or the nation as a whole more effectively than the policies introduced from top downwards.

Social and economic changes start with individuals. Changing public opinion can bring changes in government policies, which transform into action later.

Many of the environmental problems are simply there because so many people around the world contribute little bits and pieces to it. Likewise, a little effort on the part of each individual shall add up to produce significant improvement in conditions of the environment.

Activity 1:

Take any article that you use in daily life a bucket full of water, or an item of food, a table, or a book. Trace its components journey backwards from your home to their origins as natural resources in our environment. How many of these components are renewable resources and how many non-renewable?

- What is the rarity of the resource and where does it originate?
- Who uses it most intensively and how?
- How is it being overused or misused?
- Who is responsible for its improper use the resource collector, the middleman, the end user?

- How can we help to conserve it and prevent its unsustainable use?

ACTIVITY 2:

TRY TO ANSWER THE QUESTIONS ABOVE FOR ONE OF THE COMPONENTS IN THE ARTICLE YOU CHOSE IN ACTIVITY 1. THEN ANSWER THE FOLLOWING QUESTIONS:

- Are you using that resource unsustainably?
- In what ways could you reduce, reuse and recycle that resource?
- Is there an unequal distribution of this resource so that you are more fortunate than many others who have less access to it?

Importance of Environment

Environment is not a single subject. It is an integration of several subjects that include both Science and Social Studies. To understand all the different aspects of our environment we need to understand biology, chemistry, physics, geography, resource management, economics and population issues.

We live in a world in which natural resources are limited. Water, air, soil, minerals, oil, the products we get from forests, grasslands, oceans and from agriculture and livestock, are all a part of our life support systems.

As we keep increasing in numbers and the quantity of resources each of us uses also increases, the earth's resource base must inevitably shrink.

The earth cannot be expected to sustain this expanding level of utilization of resources. Added to this is misuse of resources.

We waste or pollute large amounts of nature's clean water; we create more and more material like plastic that we discard after a single use; and we waste colossal amounts of food, which is discarded as garbage.

Manufacturing processes create solid waste by-products that are discarded, as well as chemicals that flow out as liquid waste and pollute water, and gases that pollute the air.

Increasing amounts of waste cannot be managed by natural processes. These accumulate in our environment, leading to a variety of diseases and other adverse environmental impacts now seriously affecting all our lives.

Air pollution leads to respiratory diseases, water pollution to gastro-intestinal diseases, and many pollutants are known to cause cancer.

Improving this situation will only happen if each of us begins to take actions in our daily lives

that will help preserve our environmental resources. We cannot expect Governments alone to manage the safeguarding of the environment, nor can we expect other people to prevent environmental damage. We need to do it ourselves. It is a responsibility that each of us must take on as ones own.

ACTIVITY 2: EXERCISES IN SELF LEARNING ABOUT THE ENVIRONMENT ATTEMPT TO ASSESS THE LEVEL OF DAMAGE TO THE ENVIRONMENT DUE TO YOUR ACTIONS THAT HAVE OCCURRED DURING YOUR LAST WORKING DAY, THE LAST WEEK, THE LAST YEAR. THEN ESTIMATE THE DAMAGE YOU ARE LIKELY TO DO IN YOUR LIFE-TIME IF YOU CONTINUE IN YOUR PRESENT WAYS.

EXAMPLE – PLASTIC: PLASTIC BAGS, PLASTIC BALL PENS.
THINK ABOUT ALL THE ARTICLES YOU USE DAILY THAT ARE MADE FROM PLASTIC. PLASTIC PLAYS AN IMPORTANT PART IN OUR MODERN LIVES.
MAKE A LIST OF THE PLASTIC ARTICLES YOU USUALLY USE.
HOW CAN YOU REDUCE THE AMOUNT OF PLASTIC YOU USE?
WHAT EFFECTS DOES PLASTIC HAVE ON OUR ENVIRONMENT?
WHERE DID THE PLASTIC COME FROM/HOW IS IT MADE?
WHAT HAPPENS TO IT WHEN YOU THROW IT AWAY/WHERE DOES IT GO?

EXAMPLE – FOSSIL FUELS:
HOW MUCH DO YOU USE?
CAN YOU REDUCE YOUR CONSUMPTION?
WHAT EFFECT DOES IT HAVE ON THE AIR WE BREATHE?
WHEN WE LEAVE A MOTORBIKE OR CAR RUNNING DURING A TRAFFIC STOP, WE DO NOT USUALLY REMEMBER THAT THE FUEL WE ARE WASTING IS A PART OF A NONRENEWABLE RESOURCE THAT THE EARTH CANNOT RE-FORM.
ONCE ALL THE FOSSIL FUELS ARE BURNT OFF, IT WILL MEAN THE END OF OIL AS A SOURCE OF ENERGY. ONLY IF EACH OF US CONTRIBUTES OUR PART IN CONSERVING FOSSIL BASED ENERGY CAN WE MAKE IT LAST LONGER ON EARTH.

EXAMPLE – WATER:
HOW MUCH DO YOU REALLY NEED TO USE, AS AGAINST HOW MUCH YOU WASTE WHEN YOU:
(A) BRUSH YOUR TEETH?
(B) HAVE A BATH?
(C) WASH CLOTHES?
(D) WASH THE SCOOTER OR CAR?
WHERE DID THE WATER COME FROM?
WHAT IS ITS ACTUAL SOURCE?
HOW HAS IT REACHED YOU?
WHERE WILL THE WASTE WATER GO?
DO YOU FEEL YOU SHOULD CHANGE THE WAY YOU USE WATER?
HOW CAN YOU CHANGE THIS SO THAT IT IS MORE SUSTAINABLE?

EXAMPLE – FOOD:
WHERE HAS IT COME FROM?
HOW IS IT GROWN?
WHAT CHEMICALS ARE USED IN ITS PRODUCTION?
HOW DOES IT REACH YOU?
HOW IS IT COOKED?
HOW MUCH IS WASTED?
HOW IS THE WASTE DISPOSED OFF?

EXAMPLE – PAPER:
WHAT IS IT MADE FROM?
WHERE DOES IT COME FROM AND WHAT HAPPENS DURING MANUFACTURE?
HOW MUCH DO YOU USE AND HOW MUCH DO YOU WASTE?
HOW CAN YOU PREVENT IT FROM BEING WASTED?

EXAMPLE – ELECTRICAL ENERGY:
HOW MUCH DO YOU USE EVERYDAY?
WHERE DOES IT COME FROM?
HOW DO YOU WASTE IT? HOW CAN YOU CONSERVE ENERGY?

Productive value of nature:

As scientists make new advances in fields such as biotechnology we begin to understand that the world's species contain an incredible and uncountable number of complex chemicals.

These are the raw materials that are used for developing new medicines and industrial products and are a storehouse from which to develop thousands of new products in the future. The flowering plants and insects that form the most species-rich groups of living organisms are thus vital for the future development of man.

If we degrade their habitat these species will become extinct. If one sees being sold or used, a product that comes from an illegally killed wild species, if we do not inform the authorities, we become party to its extinction. Once they are lost, man cannot bring them back.

When we permit the destruction of a forest, wetland or other natural area and do not protest about it, future generations are being denied the use of these valuable resources and will blame us for these rash and negligent actions towards the environment.

Thus, the urgent need to protect all living species is a concept that we need to understand and act upon. While individually, we perhaps cannot directly prevent the extinction of a species, creating a strong public opinion to protect the National Parks and Wildlife Sanctuaries in which wild species live is an importance aspect of sustainable living.

There is a close link between agriculture and the forest, which illustrates its productive value. For crops to be successful, the flowers of fruit trees and vegetables must be pollinated by insects, bats and birds. Their life cycles however frequently requires intact forests.

Aesthetic/Recreational value of nature:

The aesthetic and recreational values that nature possesses enlivens our existence on earth. This is created by developing National Parks and Wildlife Sanctuaries in relatively undisturbed areas. A true wilderness experience has not only recreational value but is an incredible learning experience. It brings about an understanding of the oneness of nature and the fact that we are entirely dependent upon the intricate functioning of ecosystems.

The beauty of nature encompasses every aspect of the living and non-living part of our earth. One can appreciate the magnificence of a mountain, the power of the sea, the beauty of a forest, and the vast expanse of the desert. It is these natural vistas and their incredible diversity of plant and animal life that has led to the development of several philosophies of life. It has also inspired artists to develop visual arts and writers and poets to create their works that vitalize our lives.

This has been described as nature tourism, or wildlife tourism, and is also one aspect of adventure tourism. These recreational facilities not only provide a pleasurable experience but are intended to create a deep respect and love for nature.

They are also key tools in educating people about the fragility of the environment and the need for sustainable lifestyles. In an urban setting, green spaces and gardens are vital to the psychological and physical health of city dwellers.

It provides not only an aesthetic and visual appeal but the ability to ensure that each individual is able to access a certain amount of peace and tranquillity. Thus, urban environmental planners must ensure that these facilities are created in growing urban complexes.

Another important conservation education facility in urban settings includes the need to set up well designed and properly managed zoological parks and aquariums. These have got great value in sensitizing school students to wildlife. Many young people who frequented zoos as young children grow up to love wildlife and become conservationists.

In the absence of access to a Protected Area, a botanical garden or a zoo, one concept that can be developed is to create small nature awareness areas with interpretation facilities at district and taluka levels. These areas can be developed to mimic natural ecosystems even though they could be relatively small in size. Such nature trails are invaluable assets for creating conservation education and awareness. They can be developed in a small woodlot, a patch of grassland, a pond ecosystem, or be situated along an undisturbed river or coastal area. This would bring home to the visitor the importance of protecting our dwindling wilderness areas.

The option values of nature:

While we utilise several goods and services of nature and enjoy its benefits, we must recognize that every activity that we do in our daily lives has an adverse impact on nature's integrity.

Thus, if we use up all our resources, kill off and let species of plants and animals become extinct on earth, pollute our air and water, degrade land, and create enormous quantities of waste, we as a generation will leave nothing for future generations.

Our present generation has developed its economies and lifestyles on unsustainable patterns of life. however, nature provides us with various options on how we utilize its goods and services. This is its option value. We can use up goods and services greedily and destroy its integrity and long term values, or we can use its resources sustainably and reduce our impacts on the environment. The option value allows us to use its resources sustainably and preserve its goods and services for the future.

NEED FOR PUBLIC AWARENESS

As the earth's natural resources are dwindling and our environment is being increasingly degraded by human activities, it is evident that something needs to be done.

We often feel that managing all this is something that the Government should do. But if we go on endangering our environment, there is no way in which the Government can perform all these clean-up functions.

It is the prevention of environment degradation in which we must all take part that must become a part of all our lives. Just as for any disease, prevention is better than cure. To prevent ill-effects on our environment by our actions, is economically more viable than cleaning up the environment once it is damaged.

Individually we can play a major role in environment management. We can reduce wasting natural resources and we can act as watchdogs that inform the Government about sources that lead to pollution and degradation of our environment

This can only be made possible through mass public awareness. Mass media such as newspapers, radio, television, strongly influence public opinion. However, someone has to bring this about. If each of us feels strongly about the environment, the press and media will add to our efforts.

Politicians in a democracy always respond positively to a strong publicly supported movement. Thus if you join an NGO that supports conservation, politicians will make green policies. We are living on spaceship earth with a limited supply of resources. Each of us is responsible for spreading this message to as many people as possible.

Suggested further activities

- Join a group to study nature, such as WWF-I or BNHS, or another environmental group.
- Begin reading newspaper articles and periodicals such as 'Down to Earth', WWF-I newsletter, BNHS Hornbill, Sanctuary magazine, etc. that will tell you more about our environment. There are also several environmental websites.
- Lobby for conserving resources by taking up the cause of environmental issues during discussions with friends and relatives
- Practice and promote issues such as saving paper, saving water, reducing use of plastics, practicing the 3Rs principle of reduce, reuse, recycle, and proper waste disposal.
- Join local movements that support activities such as saving trees in your area, go on nature treks, recycle waste, buy environmentally friendly products.
- Practice and promote good civic sense such as no spitting or tobacco chewing, no throwing garbage on the road, no smoking in public places, no urinating or defecating in public places.
- Take part in events organised on World Environment Day, Wildlife Week, etc.
- Visit a National Park or Sanctuary, or spend time in whatever nature you have near your home.

Institutions in Environment

There have been several Government and Nongovernment organizations that have led to environmental protection in our country. They have led to a growing interest in environmental protection and conservation of nature and natural resources. The traditional conservation practices that were part of ancient India's culture have however gradually disappeared. Public awareness is thus a critical need to further environmental protection. Among the large number of institutions that deal with environmental protection and conservation, a few well-known organizations include government organisations such as the BSI and ZSI, and NGOs such as BNHS, WWF-I, etc

Bombay Natural History Society (BNHS), Mumbai

The BNHS began as a small society of six members in 1883. It grew from a group of shikaris and people from all walks of life into a major research organisation that substantially influenced conservation policy in the country.

The influence on wildlife policy building, research, popular publications and peoples action have been unique features of the multifaceted society. Undoubtedly its major contribution has been in the field of wildlife research.

It is India's oldest conservation research-based NGO.

The BNHS publishes a popular magazine called Hornbill and also an internationally well-known Journal on Natural History. "The book of Indian birds", "The butterflies of India", "Bharat ke Pakshi"

World Wide Fund India for Nature (WWF-I), New Delhi:

The WWF-I was initiated in 1969 in Mumbai after which the headquarters were shifted to Delhi with several branch offices all over India.

The early years focused attention on wildlife education and awareness. It runs several programs including the Nature Clubs of India program for school children and works as a think tank and lobby force for environment and development issues.

Centre for Science and Environment (CSE), New Delhi:

Centre for Science and Environment (CSE) is a public interest research and advocacy organisation based in New Delhi. Activities of this Centre include organising campaigns, holding workshops and conferences, and producing environment related publications.

It published a major document on the 'State of India's Environment', the first of its kind to be produced as a Citizen's Report on the Environment.

The CSE also publishes a popular magazine, 'Down to Earth', which is a Science and Environment fortnightly. It is involved in the publication of material in the form of books, posters, video films and also conducts workshops and seminars on biodiversity related issues.

CPR Environmental Education Centre, Madras:

The CPR EEC was set up in 1988. It conducts a variety of programs to spread environmental awareness and creates an interest in conservation among the general public. It focussed attention on NGOs, teachers, women, youth and children to generally promote conservation of nature and natural resources. Its programs include components on wildlife and biodiversity issues. CPR EEC also produces a large number of publications.

Centre for Environment Education (CEE), Ahmedabad:

The Centre for Environment Education, Ahmedabad was initiated in 1989. It has a wide range of programs on the environment and produces a variety of educational material. CEE's Training in Environment Education (TEE) program has trained many environment educators.

Bharati Vidyapeeth Institute of Environment Education and Research (BVIEER), Pune:

This is part of the Bharati Vidyapeeth Deemed University. The Institute has a PhD, a Masters and Bachelors program in Environmental Sciences. It also offers an innovative Diploma in Environment Education for in-service teachers.

Uttarkhand Seva Nidhi (UKSN), Almora:

The Organisation is a Nodal Agency which supports NGOs in need of funds for their environment related activities. Its major program is organising and training school teachers to use its locale specific Environment Education Workbook Program.

The main targets are linked with sustainable resource use at the village level through training school children. Its environment education program covers about 500 schools.

Kalpavriksh, Pune:

This NGO, initially Delhi based, is now working from Pune and is active in several other parts of India.

Kalpavriksh works on a variety of fronts: education and awareness; investigation and research; direct action and lobbying; and litigation with regard to environment and development issues. Its activities include talks and audio-visuals in schools and colleges, nature walks and outstation camps, organising student participation in ongoing campaigns including street demonstrations, pushing for consumer awareness regarding organic food, press statements, handling green alerts, and meetings with the city's administrators.

Wildlife Institute of India (WII), Dehradun:

This Institution was established in 1982, as a major training establishment for Forest Officials and Research in Wildlife Management.

Its most significant publication has been 'Planning A Wildlife Protected Area Network for India' (Rodgers and Panwar, 1988). The organisation has over the years added an enormous amount of information on India's biological wealth. It has trained a large number of Forest Department Officials and Staff as Wildlife Managers.

Its M.Sc. Program has trained excellent wildlife scientists. It also has an Environment Impact Assessment (EIA) cell. It trains personnel in ecodevelopment, wildlife biology, habitat management and Nature interpretation.

Botanical Survey of India (BSI):

The Botanical Survey of India (BSI) was established in 1890 at the Royal Botanic Gardens, Calcutta. However, it closed down for several years after 1939 and was reopened in 1954.

By 1955 the BSI had its headquarters in Calcutta with Circle Offices at Coimbatore, Shillong, Pune and Dehra Dun.

Between 1962 and 1979, offices were established in Allahabad, Jodhpur, Port Blair, Itanagar and Gangtok. The BSI currently has nine regional centres. It carries out surveys of plant resources in different regions.

Zoological Survey of India (ZSI):

The ZSI was established in1916. Its mandate was to do a systematic survey of fauna in India. It has over the years collected 'type specimens' on the bases of which our animal life has been studied over the years.

Its origins were collections based at the Indian Museum at Calcutta, which was established in 1875. Older collections of the Asiatic Society of Bengal, which were made between 1814 and 1875, as well as those of the Indian Museum made between 1875 and 1916 were then transferred to the ZSI.

Today it has over a million specimens! This makes it one of the largest collections in Asia. It has done an enormous amount of work on taxonomy and ecology. It currently operates from 16 regional centers.