ES
COURSE FILE

GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OFELECRICAL &ELECTRONICS ENGINEERING

(Name of the Subject / Lab Course) : Environment studies

(JNTU CODE) : A40006 **Programme : *UG***

Branch: CSE **Version No : *01***

Year: II **Updated on 25/11/2015**

Semester: II **No. of pages :**

Classification status (Unrestricted / Restricted)

Distribution List :

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2) Sign :

3) Design : Asst. professor

4) Date : 25/11/2015

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3) Design :	**3) Design :**
4) Date :	**4) Date :**

Approved by : (HOD) 1) Name :

2) Sign : **3) Date :**

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2. Syllabus copy

JAWAHARLAL NEHRU TECHNOLOGIVAL UNIVERSITY HYDERABAD

SYLLABUS FOR ENVIRONMENTAL STUDIES

II Year B.Tech. CSE-I Sem **L T/ P/ D C**

UNIT – I

ECOSYSTEMS : Definition, scope and importance of ecosystem, Concept of ecosyatem, Classification of ecosystems, Structure and structural components of an ecosystem, Food chains ,food webs, And ecological pyramids. Flow of energy, Biogeochemical cycles, Homeostasis / Cybernetics, Food chain concentration, Biomagnifications, ecosystems value, services and carrying capacity.

UNIT - II

NATURAL RESOURCES: Renewable and non-renewable resources – Natural resources and associated problems –Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams another effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water –Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies: Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, land use / land cover mapping.

UNIT - III

BIODIVERSITY AND ITS CONSERVATION: Introduction - Definition: genetic, species and ecosystem diversity. – Biogeographically classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - . Biodiversity at global, National and local levels. - . India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity .Food and fodder resources, Timber and non-timber forest products.

UNIT – IV

ENVIRONMENTAL POLLUTION:

Definition, Cause, effects and control measures of:a. Air pollution: Primary and secondary pollutants, Automobile and industrial pollution, Ambient air quality standards.

b. Water pollution: Point and non-point sources of pollution, Major pollutant of water and their sources, drinking water quality standards, Waste water treatment methods, ETP, STP, CETP.

c. Soil pollution: Soil as a sink of pollutants, Impacts of modern agriculture on soil, degradation of soil.

d. Marine pollution: misuse of international water for the dumping of hazardous waste, coastal pollution due to sewage and marine disposal of industrial effluents

e. Noise pollution: Sources, Industrial Noise occupational health hazards, standards, Methods of noise control

f. Thermal pollution: Heat Island effect, Radiation effects

g. Nuclear pollution: Nuclear power plants, nuclear radiations, disasters and impacts, genetical disorders.

Solid waste Management: types, collection, processing and disposal of municipal solid waste and industrial waste, composition and characteristics of e waste and its management**.**

GLOBAL ENVIRONMENTAL PROBLEMS AND GLOBAL EFFORTS:

Green house effect, green house gases and global warming, Sea level rise climate change and their impacts n environment. Ozone layer depletion and ozone depleting substances (ODS). Deforestation and desertification. International protocols: Earth summit, Kyoto protocol and montreal protocol.

UNIT – V

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN:

Definition of an Impact: Classification of imacts, positive and negative impacts, rversible and irreversible, light, moderate and severe, methods of baseline data acquisition, Impacts on different components such as human health resources, air, water, flora, fauna and society. Prediction of impacts and impact assessment methodologies. Environment Management Plan: technological solutions, Preventive methods Control technologies, greenbelt development, rain water harvesting, remote sensing and GIS methods

ENVIRONMENTAL POLICY, LEGISLATION, RULES AND REGULATIONS:

-Environment Protection Act. -Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act, Water Cess act , Wildlife Protection Act –Forest Conservation Act , Municipal solid waste management and Handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules.

TOWARDS SUSTAINABLE FUTURE

Concept of sustainable development, Threats to Sustainability, Population and its explosion, Crazy Consumerism, Over exploitation of resources, Strategies for Achieving Sustainable development, Environmental Education, Conservation of Resources, Urban sprawl, Sustainable Cities and communities, Human health, Role of IT in Environment, Environmental Ethics, Environmental Economies, Concept of green building, Clean development Mechanism.

TEXT BOOKs:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE:

1. Textbook of Environmental Sciences and Technology by M. Anji Reddy, BS Publica

2. Environmental Studies by Anubha Kaushik C.P. Kaushik

3. Vision of the Department

CSE: To produce globally competent and socially responsible computer science engineers contributing to the advancement of engineering and technology which involves creativity and innovation by providing excellent learning environment with world class facilities.

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4. Mission of the Department

CSE:

- To be a center of excellence in instruction, innovation in research and scholarship, and service to the stake holders, the profession, and the public.
- To prepare graduates to enter a rapidly changing field as a competent computer science engineer.
- To prepare graduate capable in all phases of software development, possess a firm understanding of hardware technologies, have the strong mathematical background necessary for scientific computing, and be sufficiently well versed in general theory to allow growth within the discipline as it advances.
- To prepare graduates to assume leadership roles by possessing good communication skills, the ability to work effectively as team members, and an appreciation for their social and ethical responsibility in a global setting.

5. PEOs and Pos

CSE:

PEO 1: To provide graduates with a good foundation in mathematics, sciences and engineering fundamentals required to solve engineering problems that will facilitate them to find employment in industry and / or to pursue postgraduate studies with an appreciation for lifelong learning.

PEO 2: To provide graduates with analytical and problem solving skills to design algorithms, other hardware / software systems, and inculcate professional ethics, inter-personal skills to work in a multi-cultural team.

PEO 3: To facilitate graduates to get familiarized with the art software / hardware tools, imbibing creativity and innovation that would enable them to develop cutting-edge technologies of multi-disciplinary nature for societal development.

Program outcomes (CSE)

PO 1: An ability to apply knowledge of mathematics, science and engineering to develop and analyze computing systems.
PO 2: Ability to analyze a problem and identify and define the computing requirements appropriate for its solution under given constraints.
PO 3: An ability to perform experiments to analyze and interpret data for different applications.
PO 4: An ability to design, implement and evaluate computer-based systems, processes, components or programs to meet desired needs within realistic constraints of time and space.
PO 5: An ability to use current techniques, skills and modern engineering tools necessary to practice as a CSE professional.
PO 6: An ability to recognize the importance of professional, ethical, legal, security and social issues and addressing these issues as a professional.
PO 7: An ability to analyze the local and global impact of systems /processes /applications /technologies on individuals, organizations, society and environment.
PO 8: An ability to function in multidisciplinary teams.
PO 9: An ability to communicate effectively with a range of audiences.
PO 10: Demonstrate knowledge and understanding of the engineering, management and economic principles and apply them to manage projects as a member and leader in a team.
PO 11: A recognition of the need for and an ability to engage in life-long learning and continuing professional development
PO 12: Knowledge of contemporary issues.
PO 13: An ability to apply design and development principles in producing software systems of varying complexity using various project management tools.
PO 14: An ability to identify, formulate and solve innovative engineering problems.

6. Course Objectives and Outcomes

Course Objectives (as per JNTU-H)

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding of environmental policies and regulations.

Course Objectives (as per our college plan)

- To understand the importance of ecosystem.
- To understand about the natural resources and their usage in day to day life.
- To understand the concepts of concept of bio-diversity and their values.
- To gain knowledge about different types of pollutions and their control technologies.

- To study about global environmental problems and global efforts.

Course Outcomes

After the completion of the course, the student would be able to

CO 1: Get the information about ecosystem and also about its functions like Food chain, Ecological pyramids etc.,

CO 2: Get the knowledge about the different types of resources like land, water, mineral and energy and also about the effects of environment by the usage of these resources.

CO 3: Gain the knowledge about the ecosystem diversity, its values and also about the importance of the endemic species.

CO 4: Get the complete information about the different methods of protecting the environment.

CO 5: Gain the knowledge about the different types of pollutions and their control technologies.

CO 6: Gain the knowledge about different types of pollution and their treatment techniques like waste water treatment, Bio medical waste management etc.,

CO 7: Get the complete information about EIA- Environmental Impact Assessment in which the student will get the knowledge about the projects and the process involved in getting the projects.

CO 8: Gain the knowledge about the present resources and different techniques involved in its conservation.

7. Brief Importance of the Course and how it fits into the curriculum

Environmental studies are the sciences which includes the improvement of the natural environment, to provide healthy water, air, and land for human habitation and for other organisms, and to clean up pollution sites.]

Environmental studies can also be described as a branch of applied science that addresses the issue of energy preservation, production asset and control of waste from human and animal activities. Furthermore, it is concerned with finding plausible solutions in the field of public health, such as waterborne diseases, implementing laws which promote adequate sanitation in urban, rural and recreational areas. It involves waste water management and airpollution control, recycling, waste disposal, radiation protection, industrial hygiene, environmental sustainability, and public health

issues as well as a knowledge of environmental engineering law. It also includes studies on the environmental impact of proposed construction projects.

8. Prerequisites if any

The domain of environmental science is not completely defined, and includes many smaller disciplines. Our existence, lifestyles and growth depend entirely on the sun and the earth. The energy from the sun is called solar capital. In the same way, the planets, air, water, fertile soil, forests, grasslands, wetlands, oceans, lakes, wildlife, minerals and natural purification and recycling process are treated as Earth's capital. We use the term 'environment to describe, in the language of G.T Miller, The Plant's fife -support system for us and for all other forms of life'. In effect, the environment is me sum-total of solar capital and earth capital.

9. Instructional Learning Outcomes

Learning outcomes are the key abilities and knowledge that will be assessed

UNIT – I
ECOSYSTEMS :

- scope and importance of ecosystem, Concept of ecosyatem
- structural components of an ecosystem
- Function of ecosystem like, Food chains ,food webs, And ecological pyramids. Flow of energy
- Homeostasis / Cybernatics
- ecosystems value, services and carrying capacity.

UNIT – II

NATURAL RESOURCES:

- Renewable and non-renewable resources
- Forest resources
- Land as a resource,
- Mineral resources
- Food resources:
- Energy resources
- Water resources

UNIT - III

BIODIVERSITY AND ITS CONSERVATION

- Definition: genetic, species and ecosystem diversity

- Value of biodiversity
- Hot-sports of biodiversity
- Threats to biodiversity
- Conservation of biodiversity
- Timber and non-timber forest products.
- Food and fodder resources

UNIT – IV

ENVIRONMENTAL POLLUTION

Definition, Cause, effects and control measures of:

- Air pollution
- Water pollution
- Soil pollution:
- Marine pollution
- Noise pollution
- Thermal pollution
- . Nuclear pollution
- Solid waste Management
- GLOBAL ENVIRONMENTAL PROBLEMS AND GLOBAL EFFORTS

UNIT – V

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN:

- Environmental policy, Legislation, Rules and regulation
- Environment Protection Act
- , biomedical waste management
- hazardous waste management

- Towards sustainable future

10. Course mapping with PEOs and POs

EEE: Mapping of Course with Programme Educational Objectives: (Sample)

S.No	Course component	code	course	Semester	PEO 1	PEO 2	PEO 3
1	ENVIRONMENTAL STUDIES	A40006	ENVIRONMENTAL STUDIES	1	√	✓	✓

*When the course outcome weightage is < 40%, it will be given as moderately correlated (1).
*When the course outcome weightage is >40%, it will be given as strongly correlated (2).

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Engineering Chemistry															
CO 1: Get the information about ecosystem and also about its functions like Food chain, Ecological pyramids etc.,						**1**		**1**	**1**						
CO 2: Get the knowledge about the different types of resources like land, water, mineral and energy and also about the effects of environment by the usage of these						**1**		**1**	**1**						**Environmental studies**

resources.															
CO3: Gain the knowledge about the ecosystem diversity, its values and also about the importance of the endemic species						**1**		**1**	**1**						
CO 4: Get the complete information about the different methods of protecting the environment.						**1**		**1**	**1**						
CO 5: Gain the knowledge about the different types of pollutions and their control technologies.						**1**		**1**	**1**						
CO 6: Gain the knowledge about different types of pollution and their treatment techniques like waste water treatment, Bio medical waste management etc.,						**1**		**1**	**1**						
CO 7: Get the complete information about EIA- Environmental						**1**		**1**	**1**						

Impact Assessment in which the student will get the knowledge about the projects and the process involved in getting the projects.															
CO 8: Gain the knowledge about the present resources and different techniques involved in its conservation.															

11.Time table of concerned class:

DEPARTMENT OF CSE								
Year/Sem/Sec: II B.Tech IISem				**ROOM NO : LH**		**Acad Yr : 2015-16 WEF: 29-06-2015**		
Vo 16/05/2015					**CLASS INCHARGE:**			
Time	9.30-10.20	10.20-11.10	11.10-12.00	12.00-12.50	12.50-1.30	1.30-2.20	2.20-3.10	3.10-4.00
Period	**1**	**2**	**3**	**4**	**LUNCH**	**5**	**6**	**7**
Monday								
Tuesday								
Wednesday								
Thursday								
Friday								
Saturday								

S.No	**Subject(T/P)**	**Faculty Name**	**Subject Code**	**Periods/ Week**
1				
2				
3				

4								
5								
6								
7								
8								
9	**Librar/Mentoring/sports**							
10	**CRT**							
	*** Represents Tutorial class**							

12. INDIVIDUAL TIME TABLE

Time	9.30-10.20	10.20-11.10	11.10-12.00	12.00-12.50	12.50-1.30	1.30-2.20	2.20-3.10	3.10-4.00
Period	**1**	**2**	**3**	**4**	**LUNCH**	**5**	**6**	**7**
Monday								
Tuesday								
Wednesday								
Thursday								
Friday								
Saturday								

13. Lecture schedule with methodology being used / adopted

SL.No.	**Unit No.**	**Week No.**	**Topic to be covered in One lecture**	**Regular/ Additional**	**Teaching aids used LCD/OHP/BB**	**Remarks**
1	**I**	WEEK 1	Scope and Importance of an Ecosystem	Regular	BB	
2			Classification of Ecosystem	Regular	BB	
3			Structure and Structural components	Regular	BB	
4			Forest, Grassland and desert ecosystem	Regular	BB	
5			Biogeochemical cycles, Nitrogen cycle and carbon cycle, Phosphurous cycle and hydrological cycle			

7		WEEK 2	Carrying capacity & homeostasis	Regular	BB	
7	II		Classification of Resources	Regular	BB	
8			Water Resources	Regular	BB	
8			Mineral Resources, Land Resources	Regular	BB	
9			Energy resources – Reneweble, Solar energy applications	Regular	BB	
10		WEEK 3	Non renewable resources- Fossil fuels, Nuclear energy, Chernobyl Nuclear disaster	Regular	BB	
11	III		Types of Diversity, Alpha,Beta and Gamma	Regular	BB	
			Value of Biodiversity,			
12			Red list categories- Red Data book,	Regular	BB	
13			Food and fodder resources, Timber and Non timber resources.	Regular	BB	
17		WEEK 4	Threats to Biodiversity.	Regular	BB	
18			Hot spots	Regular	BB	
			Conservation of Biodiversity			
19	IV		Classification of Pollution	Regular	BB	
20			Air Pollution.	Regular	BB	
22		WEEK 5	Soil Pollution, Noise Pollution	Regular	BB	
			Nuclear Pollution & Disasters			
23			Water pollution, Waste water treatment technologies	Regular	BB	
24			Solid waste, Thermal Pollution	Regular	BB	

25			Marine Pollution	Regular	BB	
27		WEEK 6	Green house Effect & Global Warming	Regular	BB	
28			Ozone Layer Depletion	Regular	BB	
			International Conventions			
29			Deforestation Desertification	Additional	BB	
30			Desertification	Regular	BB	
32	V	WEEK 7	Impact and Types of Impact	Regular	BB	
33			Steps involved in EIA	Regular	BB	
34			Prediction of Impacts and methodologies	Regular	BB	
35			EIS	Regular	BB	
36			EMP	Regular	BB	
37		WEEK 8	Treatment technologies	Regular	BB	
38			National Environmental Policy	Regular	BB	
39			Air Conservation Act	Regular	BB	
40			water Conservation Act	Regular	BB	
41			Forest Conservation Act	Regular	BB	
42		WEEK 9		Regular	BB	
43			Municipal Solid waste management	Regular	BB	
44			Biomedical waste management	Regular	BB	
45			Hazardous waste management	Regular	BB	
46			Water Cess Act	Regular	BB	
47	**IV**	WEEK 10	Concept of Sustainable Development	Regular		
48			Over-exploitation of Natural Resources	Regular	BB	

49			Conservation of Resources	Regular		
50			Green building technologies	Regular		
51			Types of Human diseases	Regular		
52		WEEK 11	Sustainable future	Regular		
53			Slip Test	Regular	BB	
54			Revision	Regular	BB	
55			Revision	Regular	BB	
56			Crazy Consumerism	Regular	BB	
57		WEEK 12	Over exploitation of resources	Regular	BB	
58			Strategies for Achieving Sustainable	Regular		
59			Environmental Education	Regular	BB	
60			Conservation of Resources	Regular	BB	
61	**V**		Urban sprawl, Sustainable Cities and communities	Regular	BB	
62		WEEK 13	Human health	Regular	BB	
63			Role of IT in Environment	Regular	BB	
64			Environmental Ethics	Regular	BB	
65			Environmental Economies	Regular	BB	
66			Concept of green building	Regular	BB	
67		WEEK 14	Clean development	Regular	BB	

			Mechanism			
68			Environmental Economies	Regular	BB	
69			Concept of green building	Regular	BB	
70			Clean development Mechanism	Regular	BB	
72		WEEK 15	Revision			
73			Previous Question paper Discoussion			
74			Previous Question paper Discoussion			

CSE-A

S.No	Topic to be covered in One lecture	Dates
	UNIT-I	
	ECOSYSTEM	
1	**ECOSYSTEM:** Introduction abot Environmental studies &Ecosystem	Lec1
2	Scope and Importance of an Ecosystem	Lec 2
3	Classification of Ecosystem	Lec3
4	Structure and Structural components	Lec4
5	Forest, Grassland and desert ecosystem	Lec5
6	Biogeochemical cycles, Nitrogen cycle and carbon cycle, Phosphurous cycle and hydrological cycle	Lec6

7	Carrying capacity & homeostasis	Lec7
UNIT-II		
NATURAL RESOURSES		
8	Classification of Resources	Lec8
9	Water Resources	Lec9
10	Mineral Resources, Land Resources	Lec10
11	Energy resources – Reneweble, Solar energy applications	Lec11
12	Non renewable resources- Fossil fuels, Nuclear energy, Chernobyl Nuclear disaster	Lec12
UNIT-III		
BIODIVERSITY&BIOTIC RESOURSES		
13	Types of Diversity, Alpha,Beta and Gamma	Lec13
14	Value of Biodiversity,	Lec14
15	Red list categories- Red Data book,	Lec15
16	Food and fodder resources, Timber and Non timber resources.	Lec16
17	Threats to Biodiversity.	Lec17
18	Hot spots	Lec18
19	Conservation of Biodiversity	Lec19
UNIT-IV		
ENVIRONMENTAL POLLUTION ,GLOBAL WARMING& GLOBAL ENVIRONMENTAL PROBLEMS		
20	Classification of Pollution	Lec20
21	Air Pollution.	Lec21
22	Soil Pollution, Noise Pollution	Lec22
23	Nuclear Pollution & Disasters	Lec23
24	Water pollution, Waste water treatment technologies	Lec24

25	Solid waste, Thermal Pollution	Lec25
26	Marine Pollution	Lec26
27	Green house Effect & Global Warming	Lec27
28	Ozone Layer Depletion	Lec28
29	International Conventions	Lec29
30	Deforestation Desertification	Lec30
31	Desertification	Lec31
UNIT-V		
TOWARDS SUSTAINABLE FUTURE		
32	Impact and Types of Impact	Lec32
33	Steps involved in EIA	Lec33
34	Prediction of Impacts and methodologies	Lec34
35	EIS	Lec35
36	EMP	Lec36
37	Treatment technologies	Lec37
38	National Environmental Policy	Lec38
39	Air Conservation Act	Lec39
40	water Conservation Act	Lec40
41	Forest Conservation Act	Lec41
42	Municipal Solid waste management	Lec42
43	Biomedical waste management	Lec43
44	Hazardous waste management	Lec44
45	Water Cess Act	Lec45
46	Concept of Sustainable Development	Lec46
47	Over-exploitation of Natural Resources	Lec47

48	Conservation of Resources	Lec48
49	Green building technologies	Lec49
50	Types of Human diseases	Lec50
51	Sustainable future	Lec51
52	Crazy Consumerism, Over exploitation of resources	Lec52
53	Strategies for Achieving Sustainable, Environmental Education	Lec53
54	Conservation of Resources, Urban sprawl, Sustainable Cities and communities	Lec54
55	Human health, Role of IT in Environment, Environmental Ethics	Lec55
56	Environmental Economies, Concept of green building, Clean development Mechanism	Lec56
57	Environmental Economies	Lec57
58	Concept of green building	Lec58
59	Clean development Mechanism	Lec59
60	Revision	Lec60
61	Previous Question paper Discoussion	Lec61
62	Previous Question paper Discoussion	Lec62

CSE-B

S.No	Topic to be covered in One lecture	Dates
	UNIT-I	
	ECOSYSTEM	
1	**ECOSYSTEM:** Introduction abot Environmental studies &Ecosystem	Lec1
2	Scope and Importance of an Ecosystem	Lec 2
3	Classification of Ecosystem	Lec3

4	Structure and Structural components	Lec4
5	Forest, Grassland and desert ecosystem	Lec5
6	Biogeochemical cycles, Nitrogen cycle and carbon cycle, Phosphurous cycle and hydrological cycle	Lec6
7	Carrying capacity & homeostasis	Lec7
UNIT-II		
NATURAL RESOURSES		
8	Classification of Resources	Lec8
9	Water Resources	Lec9
10	Mineral Resources, Land Resources	Lec10
11	Energy resources – Reneweble, Solar energy applications	Lec11
12	Non renewable resources- Fossil fuels, Nuclear energy, Chernobyl Nuclear disaster	Lec12
UNIT-III		
BIODIVERSITY&BIOTIC RESOURSES		
13	Types of Diversity, Alpha,Beta and Gamma	Lec13
14	Value of Biodiversity,	Lec14
15	Red list categories- Red Data book,	Lec15
16	Food and fodder resources, Timber and Non timber resources.	Lec16
17	Threats to Biodiversity.	Lec17
18	Hot spots	Lec18
19	Conservation of Biodiversity	Lec19
UNIT-IV		
ENVIRONMENTAL POLLUTION ,GLOBAL WARMING& GLOBAL ENVIRONMENTAL PROBLEMS		
20	Classification of Pollution	Lec20
21	Air Pollution.	Lec21

22	Soil Pollution, Noise Pollution	Lec22
23	Nuclear Pollution & Disasters	Lec23
24	Water pollution, Waste water treatment technologies	Lec24
25	Solid waste, Thermal Pollution	Lec25
26	Marine Pollution	Lec26
27	Green house Effect & Global Warming	Lec27
28	Ozone Layer Depletion	Lec28
29	International Conventions	Lec29
30	Deforestation Desertification	Lec30
31	Desertification	Lec31
UNIT-V		
TOWARDS SUSTAINABLE FUTURE		
32	Impact and Types of Impact	Lec32
33	Steps involved in EIA	Lec33
34	Prediction of Impacts and methodologies	Lec34
35	EIS	Lec35
36	EMP	Lec36
37	Treatment technologies	Lec37
38	National Environmental Policy	Lec38
39	Air Conservation Act	Lec39
40	water Conservation Act	Lec40
41	Forest Conservation Act	Lec41
42	Municipal Solid waste management	Lec42
43	Biomedical waste management	Lec43
44	Hazardous waste management	Lec44

45	Water Cess Act	Lec45
46	Concept of Sustainable Development	Lec46
47	Over-exploitation of Natural Resources	Lec47
48	Conservation of Resources	Lec48
49	Green building technologies	Lec49
50	Types of Human diseases	Lec50
51	Sustainable future	Lec51
52	Crazy Consumerism, Over exploitation of resources	Lec52
53	Strategies for Achieving Sustainable, Environmental Education	Lec53
54	Conservation of Resources, Urban sprawl, Sustainable Cities and communities	Lec54
55	Human health, Role of IT in Environment, Environmental Ethics	Lec55
56	Environmental Economies, Concept of green building, Clean development Mechanism	Lec56
57	Environmental Economies	Lec57
58	Concept of green building	Lec58
59	Clean development Mechanism	Lec59
60	Revision	Lec60
61	Previous Question paper Discoussion	Lec61
62	Previous Question paper Discoussion	Lec62

CSE-C

S.No	Topic to be covered in One lecture	Dates
	UNIT-I	
	ECOSYSTEM	
1	**ECOSYSTEM:** Introduction abot Environmental studies &Ecosystem	Lec1

2	Scope and Importance of an Ecosystem	Lec 2
3	Classification of Ecosystem	Lec3
4	Structure and Structural components	Lec4
5	Forest, Grassland and desert ecosystem	Lec5
6	Biogeochemical cycles, Nitrogen cycle and carbon cycle, Phosphurous cycle and hydrological cycle	Lec6
7	Carrying capacity & homeostasis	Lec7
UNIT-II		
NATURAL RESOURSES		
8	Classification of Resources	Lec8
9	Water Resources	Lec9
10	Mineral Resources, Land Resources	Lec10
11	Energy resources – Reneweble, Solar energy applications	Lec11
12	Non renewable resources- Fossil fuels, Nuclear energy, Chernobyl Nuclear disaster	Lec12
UNIT-III		
BIODIVERSITY&BIOTIC RESOURSES		
13	Types of Diversity, Alpha,Beta and Gamma	Lec13
14	Value of Biodiversity,	Lec14
15	Red list categories- Red Data book,	Lec15
16	Food and fodder resources, Timber and Non timber resources.	Lec16
17	Threats to Biodiversity.	Lec17
18	Hot spots	Lec18
19	Conservation of Biodiversity	Lec19
UNIT-IV		
ENVIRONMENTAL POLLUTION ,GLOBAL WARMING& GLOBAL ENVIRONMENTAL PROBLEMS		

20	Classification of Pollution	Lec20
21	Air Pollution.	Lec21
22	Soil Pollution, Noise Pollution	Lec22
23	Nuclear Pollution & Disasters	Lec23
24	Water pollution, Waste water treatment technologies	Lec24
25	Solid waste, Thermal Pollution	Lec25
26	Marine Pollution	Lec26
27	Green house Effect & Global Warming	Lec27
28	Ozone Layer Depletion	Lec28
29	International Conventions	Lec29
30	Deforestation Desertification	Lec30
31	Desertification	Lec31
UNIT-V		
TOWARDS SUSTAINABLE FUTURE		
32	Impact and Types of Impact	Lec32
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14. Detailed Notes

UNIT – I: ECOSYSTEM

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Introduction

Scope & concept of Ecosystem
Kinds of Ecosystem
Structure & Function of Ecosystem
Food Chain
Food Web
Ecological Pyramid
Energy flow/ Transfer of energy in the Ecosystem
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Aquatic Ecosystem
Forest Ecosystem
Desert Ecosystem
Meanings
References

INTRODUCTION OF ECOLOGY:

The term "Ecology" was derived from Greek words viz., **Oikes** means house or place and **logs** means a discussion or study. So, ecology is the **scientific study of the distribution** and the **interactions** between organisms and their natural environment.

The environment (surroundings) consists of: **living organisms (** biotic **)** and **non-living things (** abiotic **)** such as physical components of wind, temperature, rainfall, water, humidity , light, soil etc and chemical components of C,H,N,K,P,S etc..(in-organic components) and carbohydrates, proteins (organic components). Hence, Ecology involves studying the ecosystems.

According to **GEORGE JACKSON,** an Ecosystem is a natural unit consisting of all plants, animals and micro-organisms in an area functioning together with all of the non-living things.

An ecosystem is the smallest unit of biosphere that has all the characteristics to support life. Pond ecosystem, forest ecosystem, desert ecosystem, marine ecosystem, urban ecosystem are some of the examples for ecosystems.

An ecosystem vary in sizes from a few square kms to hundreds of square kms. Similarly an ecosystem may be temporary like a fresh pool / agriculture field or permanent like a forest / ocean.

Scope of ecosystem :

Ecology plays an important role in agriculture crop rotation, weed control (unwanted plant); management of grasslands, forestry etc., biological surveys, fishery surveys, conservation of soil, wild life, surveys of water bodies like rivers, lakes;

ponds etc...

Concept of ecosystem:

In an ecosystem, the interaction of life with its environment take place at many levels. A single bacteria in the soil interacts with water, air around it within a small space while a fish in a river interacts with water and other animals, rivals in a large space. .

Considering the operational point of view; the biotic and abiotic components of an ecosystem are so interlinked such that their separation from each other is practically difficult. So, in an ecosystem both organisms (biotic communities) and abiotic environment (rainfall, temperature, humidity) each influencing the properties with other for maintenance of life.

KINDS OF ECOSYSTEMS: Ecosystem may be natural or artificial.

Artificial Ecosystem: These are maintained or created artificially by man. The man tries to control biotic community as well as physico chemical environment. Eg: Artificial pond, urban area development.

Natural Ecosystem: It consists of Terrestrial and Aquatic Ecosystems which are maintained naturally.

Terrestrial Ecosystem:

This ecosystem relates to biotic components living on the land.

Vegetation dominates the community and the types of vegetation affect the climate, soil structure & a rapid exchange of O2, water & CO2

Aquatic Ecosystem:

This ecosystem relates to biotic community living in water. The types of water (fresh water, saline water, polluted water) dominate and affect the pH of water, depth of water, temperature of water etc..

Aquatic ecosystem has been sub-divided into **fresh water** and **saline water** based on the quality of water.

STURCTURE & FUNCTION of ecosystem

ECOSYSTEM

NATURAL ARTIFICIAL

TERRESTRIAL (LAND) ES

eg: Forest ecosystem

Grassland ecosystem

Desert ecosystem

AQUATIC ECOSYSTEM

Eg: River ecosystem

Marine ecosystem

Estuarine ecosystem

FRESH AQUATIC ES

Eg: rivers, streams

MARINE AQUATIC ES eg:

seas ; oceans, salt lakes

LENTIC
(stagnant waters)
eg: ponds, wells, lakes
LOTIC
(Running waters)
eg: river streams
Eg: Agricultural land, artificial pond ;
URBAN AREA
The two major aspects of an ecosystem are: (1) Structure and (2) Function together they illustrate the organization of an ecosystem.
The Structure of an ecosystem consists of:
Abiotic structure includes the **non-living things of the ecosystem** such as physical factors (soil, temperature, light & water) and chemical factors consisting the inorganic compounds (N,C, H, K, P,S) & organic compounds (carbohydrates, proteins).
Biotic structure includes plants, animals & microorganisms present in an ecosystem form the biotic component. These organisms have different nutritional behavior and status in the ecosystem and are known as **Autotrophs** (Producers), **Heterotrophs** (Consumers) & **Micro-consumers** (Decomposers) based on how do they get their food.
Hence, the structure of an ecosystem comprises:
(a) The composition of biological community species (plants, animals, microorganisms), their population, life cycles, distribution in space etc.
(b) The quantity and distribution of non-living things such as soil ; water etc .
(c) The range or intensity of conditions like temperature, light, rainfall, humidity, wind & topography plays a major role in the structure of ecosystem.
Function of ecosystem means how an ecosystem works/ operates under natural conditions. The rate of biological energy flow ; the rate of nutrient cycles ie Bio-Geo-Chemical cycles and Ecological regulation (means regulation of organisms by Environment and regulation of Environment by organisms) plays a major role in the function of an ecosystem
1. Autotrophic components (Producers) :
Autotrophic means self nourishing. Since these organisms are self nourishing, they are also called producers. Eg: Algae, Green plants, Bacteria of photo synthetic. Green plants prepare their food themselves by making use of CO_2 present in the air & water in the presence of sunlight through the process of **photosynthesis.**
$CO_2 + 2H_2O$ $CH_2O + O_2 + H_2O$
(Carbon dioxide) (Water) (Carbohydrates) (Oxygen) (Water)
A few micro-organisms which can produce organic matter (nutrients) to some extent through oxidation of certain chemicals in the absence of sunlight known as **chemo autotrophs.**
Eg: In the Ocean depths, where there is no sunlight, chemo-autotrophic bacteria make use of the heat generated by the decay of radioactive elements for preparation of their food .
2. Hetero-trophic components (Consumers) :
Hetero-trophic means dependent on others for nourishment directly or indirectly upon the autotrophs (producers) for their food. These are of the following types:
a. **Herbivores (Primary consumers) :** These animals feed directly on living plants or remains of plants. Eg: Rabbits, Deer's, Insects.

b. **Carnivores (secondary consumers):** These carnivores (flesh eating) feed on the herbivores. Eg: Snakes, birds, Lizards, fox.
c. **Tertiary consumers (or) Tertiary carnivores:** These feed on the primary & secondary consumers. Eg: Lions, Tigers.
d. **Omnivores:** These consumers feed on both plants & animals. Eg Human beings, Birds (hawk) etc…
3. Decomposers or Micro consumers: They feed on organic compounds of dead or living plants and animals for their food and energy.
They absorb some of the products from decomposed material and release organic compounds (nutrients) making them available to producers.
Eg: Bacteria, Fungi, Flagellates. The decomposers are also called as "**Saprotrophs**".
FOOD CHAIN:
The transfer of food energy from the producers (plants) through a series of organisms (Herbivores, Carnivores) successively with the repeated activities of eating and being eaten is known as food chain. In an ecosystem(s), one organism is eaten by the second which in turn is eaten by the third and so on... This kind of feeding relationship is called food chain.
Examples of food chain:
1. Grass Grasshopper Frog Snake Hawk.
2. Grass Mouse Snake Hawk.
3. Grass Rabbit Man .
4. Grass Mouse Hawk.
5. Plant leaf Caterpillar Sparrow Hawk.
Explanation: A caterpillar eats a plant leaf, a sparrow eats the caterpillar, and a hawk eats the sparrow. When they all die, they are all consumed by micro organisms like bacteria (or) fungi which break down the organic matter and convert it into simple inorganic substances that can again be used by the plants.
In nature, there are two basic types of food chains viz:
1. Grazing food chain and (2) Detritus food chain
Grazing food chain: This food chain starts with green plants (primary producers) and goes to herbivores and on to carnivores.
1. Phytoplanktons Zooplanktons Small fish Tuna.
2. Phytoplanktons Zooplanktons Fish Man.
3. Grass Rabbit Fox Tiger.
Detritus food chain: This food chain starts from dead organic matter (dead leaves / plants / animals) and goes to Herbivores and on to Carnivores and so on. .
Leaves or dead plants Soil mites Insects Birds .
Dead organic matter Bacteria Insects .
dead leaves Algae Fish Man
The dead remains of plant and animals, dead leaves and flowers & fruits are degraded by decomposers (Fungi, Bacteria) and convert the organic matter into simple substances which are then taken up by the primary producers as

nutrients.

FOOD WEB:

Food web is a net work of food chains where different types of organisms are connected at different trophic levels so that there are a number of options of eating and being eaten at each trophic level. (A trophic level refers to an organisms position in the food chain) .

In the above figure, it may be observed that there are 5 linear food chains in the food web of a grass land ecosystem.

1. Grass Grasshopper Hawk
2. Grass Grasshopper Lizard Hawk
3. Grass Rabbit Hawk
4. Grass Mouse Hawk
5. Grass Mouse Snake Hawk

ECOLOGICAL PYRAMID:

Ecological pyramids were first studied by a British ecologist **CHARLES ELTAN (1927).** An Ecological Pyramid is a graphical representation consisting various trophic levels with producers forming the base and top occupy the carnivores.

In an ecological pyramid the huge number of tiny individuals form at the base and a few large individuals occupy the top / apex . This formation is known as ecological pyramid.

Hence, **all producers** (micro & macro plants) belong to the *I trophic level*; all primary consumers belong to *II trophic level* and **organisms feeding** on these consumers belong to the *III trophic level* and so on.

The ecological pyramids are of three types. They are :

1. The pyramid of Numbers (showing population).
2. The pyramid of Biomass (showing total mass of organisms).
3. The pyramid of energy (showing energy flow).

1. The pyramid of Number:

It shows the relationships among the producers, herbivores and carnivores at successive trophic levels in terms of their number. Mostly the pyramid of number is straight (or) upright with number of individuals in successive higher trophic levels goes on decreasing from base to apex.

The maximum number of individuals occur at the producers level. They support a small number of herbivores. The herbivores, in turn, support a fewer number of primary carnivores and so on….. Top carnivores are very few in number.

For eg: (1) In a grass land ecosystem.

Grass Grasshoppers Frogs Snakes Peacock / Hawk.

For eg: (2) in a pond ecosystem:

Phytoplankton Zooplankton Fish Crane

The pyramids may be inverted in a few cases :

A single plant may support the growth of many herbivores and each herbivore in turn provide nutrition to several parasites which support many hyper-parasites. Thus, from the producer towards consumers, there is a reverse position i.e., the number of organisms gradually shows an increase making the pyramid inverted in shape.

For eg: (3) in a Forest ecosystem

Tree Birds / deer Parasites Hyper parasites

Tree Birds eagle

2. The Pyramid of Biomass: The amount of organic matter present in

environment is called biomass. In pyramids of biomass, the relationship between different trophic levels is mentioned in terms of weight of organisms**. The pyramid may be upright for grassland ecosystem and inverted for pond ecosystem.**

Eg: A vegetation produces a biomass of 1000 kg. Out of this 100 kgs of biomass for herbivores, which in turn only 10 kg of biomass for primary carnivores that gives rise 1 kg of biomass for second order carnivores and so on…

1000 kgs 100 kgs 10 kgs 1 kg

Vegetation Herbivores primary carnivores Secondary carnivores

HENCE, A VEGETARIAN DIET CAN SUPPORT A LARGER POPULATION THAN A NON – VEGETATION DIET.

3. The pyramid of energy: The amount of energy trapped per unit time and area at different trophic levels of a food chain with producers forming the base and the top carnivores at the apex is called pyramid of energy.

The energy content is generally expressed as K cal /m2 / year or KJ / m2 / year

Large Fish ---126 KJ / m2 / year

Small Fish ----840 – 126 KJ / m2 / year

Zooplankton ---- 7980 KJ / m2 / year

Phytoplankton (producers) --- 31080 KJ / m2 / year

Energy flow /Transformation of energy in Ecosystem

The movement of energy (or) transfer of energy through a series of organisms in an ecosystem from the external environment and back to the external environment again is known as **energy flow.**

In the universe, the main source of energy is SUN that produces energy in the form of light or solar radiation. Different ecosystems in the world receive variable quantities of solar energy depending upon their location on the globe.

The other chief factors that control the amount of solar energy received by an ecosystem are Latitude and Longitude ; Slope; Cloud formation; Pollutants in the atmosphere

The transformation of energy in an ecosystem begin first with the input of energy from the sun by the process of photosynthesis. Carbon dioxide is combined with hydrogen (derived from the splitting of water molecules) to produce carbohydrates (CH2O) and the energy is stored in the high energy bonds of Adenosine Tri Phosphate (ATP).

Herbivores obtain their energy by consuming plants or plant products, ***carnivores*** eat herbivores and **micro-organisms** consume the droppings and carcasses (dead bodies). In an ecosystem, the utility of energy is taken place in the following manner:

The SUN provides heat to maintain the required temperature in which proper Physical and chemical processes can take place. Certain bacteria obtain useful energy by oxidation of a few elements such as sulphur and iron.

BIO – GEO-CHEMICAL CYCLES: In every ecosystem sunlight or solar radiant energy is accepted by producers (green plants) and the energy doesn't recycle through an ecosystem. But nutrients like Carbon; Nitrogen; Oxygen, Hydrogen; Water, Sulphur; Phosphorous etc move in circular paths through biotic and abiotic components and they are known as **Bio-geochemical cycles.**

About forty chemical elements are considered to be essential for living organisms. They are macronutrients of C, H, O, P, K, I, N, S , Mg, Ca etc.. and micro nutrients of Cu, Fe, Co……While all inorganic nutrients have cycles, we focus on the following:

WATER CYCLE
CARBON CYCLE
OXYGEN CYCLE
NITROGEN CYCLE
POTASSIUM CYCLE
PHOSPHOROUS CYCLE

THE WATER CYCLE OR HYDROLOGIC CYCLE

Due to the solar heat, water evaporates or water is lost to the atmosphere as vapour from the seas / oceans which is then precipitated back in the form of rain, snow, frost etc.. The evaporation and precipitation continues for ever, and thereby a balance is maintained between the two. This process is known as Hydrologic cycle.

THE CARBON CYCLE: All life is based on the element carbon and hence carbon is the main constituent of living organisms.. Carbon may be present in most organic matter from fossil fuels to the complex molecules (DNA & RNA). In fact, the lithosphere is only 0.032% carbon by weight. In comparision, oxygen and silicon make up 45.2% and 29.4% respectively of the earth's surface rocks.

Plants absorb CO2 during photosynthesis whereas animals emit CO2 during respiration. Animals obtain all their carbon through their food and thus, all carbon in biological systems ultimately comes from plants (autotrophs). The dead bodies of plants and animals as well as the body wastes are decomposed by micro-organisms which release carbon in the form of CO2.

Even plant debris if buried a longer time cause for the formation of coal, oil, natural gas and these releases carbon when they burned. Otherwise, the carbon in limestone or other sediments released to the atmosphere when they are subducted (using forces) or undergo chemical reactions. The weathering of rocks also contribute CO2 into the environment .

OXYGEN CYCLE: Oxygen is present in CO2, CH2O (carbohydrates) and H2O. Oxygen is released into the atmosphere by plants during photosynthesis and taken up both autotrophs and Heterotrophs during respiration.

All the oxygen in the atmosphere is biogenic ie., it was released from water through the process of photosynthesis.

Because of the vast amounts of oxygen in the atmosphere, even if all photosynthesis cease it would take 5000 million years to strip out more or less all oxygen.

NITROGEN CYCLE: Nitrogen is used by living organisms to produce a number of complex organic molecules like Amino acids; Proteins ; Nucleic acids ; Enzymes; Chlorophyll etc..

The largest reservoir of nitrogen is the atmosphere where it exists as a gas mainly N2. But atmospheric nitrogen is not utilized directly. However, nitrogen gas undergoes many changes in the nitrogen cycle like:

NITROGEN FIXATION; AMMONIFICATION; NITRIFICATION

Nitrogen fixation or conversion of free nitrogen into biologically acceptable

form is referred to as Nitrogen Fixation.
$N_2 + 2(O)$ electric discharge $2\ NO$
Nitrogen gas oxygen radical nitrogen oxide
In physico chemical process; nitrogen combines with oxygen during lightning or electrical discharges in the clouds and produces different nitrogen oxides (N_2O_5).
These nitrogen oxides get dissolved in rain water and react with mineral compounds to form Nitrates and Nitrogenous compounds on the earth.
$N_2O_5 + H_2O\ 2HNO_3$
$2HNO_3 + CaCO_3\ Ca(NO_3)_2 + CO_2 + H_2O$
Nitrogen fixation is also carried out by biological process by means of blue – green algae in the oceans. (1) Eg: rhizobium bacteria fix nitrogen in the roots of Leguminous plants (2) Eg: Blue – green algae (Nostoc, Anabena) fix Nitrogen.
Ammonification: when plants or animals die or release waste, the nitrogen is returned to the soil as ammonia. The bacteria (nitrite bacteria) in the soil and in the water which take up ammonia and convert it to Nitrite (NO_2). Another bacteria (Nitrate bacteria) take nitrite and convert it to Nitrate (NO_3) which can be taken up by plants to continue the cycle.
Nitrification means conversion of ammonia into nitrite by some of the bacterias such as Nitrosmonas, Nitrococcus in oceans and soils.
POTASSIUM CYCLE: The major role of potassium in living organisms is osmotic control and potassium is taken up, retained and excreted in ionic form (K^+). The amount of potassium in soil solution is relatively small.
Soils contain potassium in more slowly exchangeable forms which act as sources for crops. In some soils, for example clays, this source of potassium is adequate to meet the requirements of cereals for decades without supplementation with fertilizers. The main pathways for potassium through the plant and soil are mentioned below :
Plant K: Potassium is an essential nutrient in maintaining the osmotic regulation of plant cells. It will constitute between I .6 and 2.5% of the leaf dry matter in healthy leaves.
Fertilizer and manure: The principle sources of potash are manures and sulphate salts. In animal manures, the potash is not biologically fixed to other compounds, unlike nitrogen and phosphate, and thus is readily available to plants. Common fertilizers utilize the muriate (chloride) and sulphate salts of potassium. Chloride, which is not toxic at agronomic applications, should not be confused with chlorine which is a poisonous gas. Manure and fertilizer potassium contribute to potassium in soil solution.
Soil Solution (K^+): Potassium in solution is immediately available to plants. The amount of potassium in solution varies with fertilizer application, and cropping history but the amount is generally not enough to meet the requirements of the crop.
Leaching: Where the amount of potassium added to the soil in fertilizers or manures exceeds the exchange capacity of the soil, potassium can be lost by leaching.
THE PHOSPHOROUS CYCLE: Phosphorous is present in rocks in the form of phosphate. When rocks containing phosphate are exposed to water, the phosphate goes into solution. Plants and Fungi have a symbiotic relationship . Plants get phosphates from fungi and give them sugar in return. Phosphorous is an important constituent of cell membrane, DNA, RNA and

ATP. Animals obtain phosphorous from plants through food. Phosphorous is a component of bones, teeth and shells. When animals or plants die, the phosphates are returned to the soil or water by the decomposers. Most of the phosphates escape into the sea through the waters, where part of phosphate is deposited in the sediments. This phosphorous will be released when the rock is brought to the surface and weathered.

Marine birds consume phosphorous containing fish from the oceans, their **guano** (Guano is a natural manure composed chiefly of the excrement of sea birds) .which falls on land as a high content of phosphorous. Thus marine birds and fish play an important role in returning phosphorous to the cycle.

Aquatic eco system

Eco system that exists in water is known as aquatic ecosystem . Water is the primary requirement for life in biological community. The aquatic ecosystems range from a small pond to a large ocean.

Varying quantities of nutrients are carried from terristrial (land) ecosystem by the movement of water and deposited in aquatic ecosystems. The life in aquatic communities is influenced mostly by physical factors like**:**

Water depth;
amount light;
temperature;
salinity of water and
amount of oxygen and Carbondioxide.

Aquatic ecosystems are broadly classified into ***fresh water*** and ***marine water*** ecosystems. In some regions, the marine and fresh water environments overlaps creating "***Estuaries***".

AQUATIC ECOSYSTEM

FRESH WATER MARINE ESTUARIES

Eg: lakes, ponds, eg: salt lakes, seas eg: water bodies streams, rivers oceans mix of fresh & sea water

I. PONDS & LAKE ECOSYSTEMS: A pond is a small area of still water, especially is artificial whereas a lake is a large area of water body and the water is natural. The life span of ponds range from a few weeks or months and whereas the life span for lakes depend upon their location, size and depth.

Depending upon temperature, the upper part of the lake becomes warm and is called ***eplimnion*** and the lower part of the lake becomes cold which is called as ***hypolimnion.*** These two zones are separated by **thermocline zone** which acts as a barrier to exchange of material / nutrients within the pond.

During rainy season, entire water body gets same temperature due to mixing of water while in non-rainy season very small amount of mixing occurs by surface waves due to wind blow.

The ***non-living (abiotic) components*** of a pond include Heat; light, pH value of water; organic compounds (water, CO_2, O_2, Ca, N, P ..) and ***living (biotic) component***s of Autotrophs or producers (green plants, bacteria, rooted plants of Trapa, Typha, Sagi Haria) ; Consumers (Herbivores, insects and large fish) and micro cosumers (bacteria, fungi,…).

2. STREAM & RIVER ECOSYSTEMS: Rivers and streams are flowing fresh water bodies. Out of all natural ecosystems, rivers are the most intensively used ecosystems by man. The organization of river and stream ecosystem include:

ABIOTIC COMPONENTS include volume of water, speed of water flow, dissolved oxygen content, temperature etc.. The energy flow usually the organic matter which is being imported from adjacent terrestrial ecosystems.
BIOTIC COMPONENTS include Producers (algae, grass, amphibians); consumers (leaches, water insects, snails, fishes, crocodiles, reptiles) and Decomposers (bacteria, fungi, protozoa).
3. ***OCEAN OR MARINE ECOSYSTEMS:*** The marine environment is characterized by its high concentration of salts and minerals. The major oceans of the world are Atlantic; Pacific; Indian, Arctic and Antarctic. These are deep and life extends to all its depths. The sea water contains salt content in the form of NaCl and rest are Mg, Ca, K . Temperature ranges from 0o to 30o C and pressure of 1 ATM at surface and 1000 ATM at bottom of oceans.
The ocean ecosystem consists of the following;
Biotic components of Producers (phytoplanktons, marine plants , Ruppia, Zostera, Halophile are true marine angiospers); Consumers of Molluscas, fishes etc and Decomposers of bacteria and Fungi.
Abiotic components include Na, Cl, Mg, Ca, Sulphur, Dissolved oxygen content, light , temperature , pressure variations etc.
IV. ESTUARINE ECOSYSTEM: Estuary is the area at the mouth of the river joins the sea and continents. It has a free connection with the open sea and is thus strongly affected by tidal action. Estuaries are mixed with fresh water from land drainages. River mouth, coastal bay etc are the examples for estuarine ecosystem.
Estuaries are one among the naturally fertile in the world. The components of Estuarine ecosystem are given below:
Abiotic components: Estuaries have their own ecological characteristics. Physical factors such as salinity, temperature, tidal activity etc are variable in estuaries when compared to the sea or ocean.
Biotic components include Producers, consumers and Decomposers.
Producers: Three major life forms of Autotrophs play a significant role in grass production. They are (a) macrophytes (sea weeds, sea grass, spartina, Thalassia, marsh grass, nagrove trees) (b) Phytoplankton and (c) Benthic flora (algae).
Consumers include a number of zooplankton, oysters, crabs and some species of fishes capable of surviving in estuarine conditions form primary, secondary, tertiary consumers of the estuarine ecosystem.
Decomposers include bacteria and fungi which actively take part in the breaking down the complex and dead organic matter (Fungi of actinomycites).
Forest ecosystem
Introduction: Forest is a type of terrestrial (land) ecosystem. It consists of f trees, shrubs or woody vegetation occupying an extensive area of land. Forests are important renewable resources.
A different types of forests are seen on this earth. The type of forest depend upon its geographical location and environment factors (Temperature and moisture) that influence the kind of vegetation that occur in an area.
Types of forests:
1. Savannas: These forests develop where a seasonal rainfall occurs. The grass lands of North Africa are known as savannas. Eg: North Africa, America, Burma & India.

2. Tropical forests: These exits in areas of good rainfall (>200cm per year) with uniform warm temperature. The Soils found in there forests are old, acidic in nature & poor in nutrients. Eg: Amazon rain forest (South America, India).
3. Deciduous forests (or) Temperate forests: Deciduous forests consists of broad leaved trees & occur where rainfall is plenty (750 - 1000 cms per year). Eg: Europe & North-East America.
4. Coniferous forest: These occur in areas with long winters with heavy snowfall. In other words, where moisture is limited & rainfall is low. Herbivores (animals eating plants) & insects exist in these forests. Eg: Moscow.
(5) Tundras: These are the large flat Arctic regions of Northern Europe, Asia and North America where no trees grow and where the soil below the surface of the ground is always frozen. The growing season is short and plants grow very slowly.
Following are the types of forests present in INDIA:
1. Tropical, forests present in Western Ghats of Maharashtra, Karnataka, Kerala.
2. Deciduous forests present at Dehradun, Eastern Ghats of Andhra Pradesh, Tamil Nadu, M.P., U.P.
3. Littoral and swamp forests present at Sunderbans in West Bengal and Andaman islands.
4. Tropical Thorn forests present in New Delhi, Punjab and Gujarat.
5. Mountain wet temperature forests present at Nilgiri and Palani hills.
6. Alpine scrub forests present at Ladakh and Sikkim.
The characteristic features of a forest ecosystem are as follows:
Abiotic components include inorganic and organic compounds and dead organic debris. Further, the natural light conditions are different in forests due to complex stratification in the vegetation.
Biotic components include Producers, consumers and Decomposers.
Producers: These are plants and trees and produce the food through photosynthesis. The dominant species of trees are Quercus, Acer, Betula, Thuja, Picea, Abies, Pinus, Cedrus etc…
Consumers: The primary consumers are Ants, beetles, leaf hoppers, bugs, spiders, deers, squirrels etc. The secondary consumers are Snakes, birds, lizards, foxes etc are the examples. The tertiary consumers are lion, tiger, hawk etc.
Decomposers include micro organisms like bacteria, fungi etc.. consume the dead or decayed bodies.
Tropical rain forests are found in the hot and humid regions near the equator: These regions have abundant rainfall (2000 – 4500 mm per year) that occurs almost daily. These forests are found in South and Central America, Western and Central Africa , SE Asia and some islands of the Indian & Pacific Oceans.
These rain forests are marked by a variety of tall trees and a dense canopy. The soils are thin and acidic with poor nutrients. A team of Brazilian scientists conducted a research and found that a forest could return as much as 75% of the moisture it received back into atmosphere. Hence, more trees are meant for more rain.
Temperate forests are very cold in winter and warm or humid in summer. These forests grow where the annual rainfall is about 750 – 2000 mm per year and are found in Western and Central Europe, Eastern Asia, Eastern America.

Soil is rich in temperate forest areas. oaks, maples, beech, pine trees, ferns, lichens, mosses etc are found in these forests.
Temperate forests contain abundant micro – organisms and mammals (squirrels, porcupines, chipmunks, raccoons, hares, deer, foxes, coyotes, bears. Birds like warblers, wood peckers, owls, hawks are seen. Snakes, frogs are also common these forests.
Coniferous forests derive the name from the abundance of coniferous trees like spruce, fir, pine, hemlock etc. Coniferous tree produces dry fruits called cones. In coniferous forests, winters are usually long and cold. The soil in these forests is acidic and humus rich.
The main animals found in these forests are deer, moose, elk, caribon, mice, hares, squirrels, foxes, bears and birds.
Status of Forests in India:
Forest Survey of India (FSI) , Dehradun estimated, the country's forest cover as 6,76,000 sq km . Of this 6,76,000 sq km; 259000 sq km is open forest, 417000 sq km is covered by dense forest and mangroves occupied 4490 sq kms. Madhya Pradesh accounts for the largest forest cover of the country with 77265 sq km followed by Arunachal Pradesh 68045 sq km and Chhattisgarh with 56448 sq km.
Desert ecosystem
Deserts occur in regions when the annual rainfall is in the range of 250 to 500 mm and **evaporation rate is high.** Deserts occupy about 30% of land area on the globe. Deserts are found 30 above north and below south of the equator. Deserts are characterized by extremely hot days and cold nights. The largest deserts are found in the interiors of continents where moisture bearing winds do not reach. The desert soils has very little organic matter but rich in minerals. The desert plants have adapted to the dry conditions and conserve water by having few or no leaves.
eg: (1) A plant namely Saguaro cactus has a stem that can expand to store water
(2) Many desert plants have thorns or toxins to protect themselves from being grazed by animals.
(3) Some desert plants have wax – coated leaves that minimize the loss of moisture.
(4) Some desert plants have deep roots that reach the ground water.
(5) A few desert plants have shallow roots that collect water after any rain and store it in spongy tissues.
Desert ecosystem is characterized by scanty flora and fauna. The organisms which with stand the extreme temperatures can survive here. Desert animals are usually small in size and come out during the nights for food.
Human impact on deserts.:
Slow rate of growth of vegetation if topsoil is eroded due to a heavy vehicle transportation across the desert. Desert cities, depletion of ground water, land disturbance, pollution from mining, storage of toxic wastes are some of the human activities that cause damage.
Abiotic components include temperature, rainfall, soil, water etc plays a major role to control the desert ecosystem.
Biotic components include **producers** (shrubs, bushes, grasses, a few trees and plants namely Cacti, Acacias, Euphorbias); **Consumers** of insects, reptiles,

rodents of rats & rabbits; birds, camels which are capable of living under desert conditions and **Decomposers** include Bacteria, Fungi due to poor vegetation and the less quantity of dead organic matter. .

A Case study of Desert ecosystem:

The Thar desert (the Great Indian Desert) is spread over four states in India __ Punjab; Haryana; Rajasthan and Gujarat and two states in Pakistan. Thar desert covers an area of about 4,46,000 sq kms.

Though the Thar desert is smaller than the Sahara desert in Africa and the Gobi desert in Russia, the Thar desert is most populated in the world with about 13 million people.

The average rainfall is between 100 mm and 500 mm. The only river in the region is the **Ghaggar** which enters Rajasthan from Punjab and dries up in the forest.

The Thar desert has no Oasis. Flowering plants like shrubs, grasses, trees (Khejra, Babul, Rohida); fruit trees (Ber; Pilu) are found in Thar desert.

Sheep, goats, camels are the common animals found in the Thar desert. In addition, wild ass, black buck deer, hare, red lynx, Jackal, Wild dog etc..

About 23 species of Lizard and 25 species of snakes are found in Thar desert region.

ECOSYSTEM (UNIT - I) meanings

Abiotic Non – living organisms (soil, temp, light, water, inorganic components of N,C,H,K,P,S)

Algae Simple plant with no leaves. Stems or roots that grow in water

Bacteria Simple and smallest form of life exist in water, air, soil and causes of diseases

Biomass An organic material from living beings or its residues (wood, animal manure)

Biome A characteristic plants & animals that exist in a particular type of environment

Biotic Living organisms

Carnivores (sec consumers) Dependent on herbivores (snakes, birds, lizards)

Chemo autotrophs Micro organisms produce organic matter through oxidation of chemicals in the absence of sunlight.

Consumers (Heterotrophs) Depends on others for nourishing food

Decomposers Feed on organic compounds of dead or living plants & animals

Ecological Succession Development of ecosystem

Fauna Animals

Feeding levels (Trophic levels) A trophic level refers to an organisms position in the food chain

Flora Plants

Fungi (mushrooms,Mildew) Any plant without leaves, flowers or green colouring growing on other plants or decaying matter

Herbivores Depends on plants (rabbit, deers)

Humus A substance made from dead leaves & plants added to soil to help plants grow

Inorganic Not consisting of or coming from any living substances

Lentic Standing water

Lotic Running water

Nourishing To keep a person / animal or plant alive with food

Oasis An area in the desert where there is water

Omnivores Depends on plants & animals (human beings, birds)

Organic Produced by or from living things (proteins, carbohydrates, fats)
Plankton Very small plants / insects
Producers (Autotrophs) Self nourishing (algae, green plants)
Puddle A small place where rain water accumulates
Sea weed A plant that grows in the sea or ocean or on rocks at the edge of the sea.
Tertiary consumers Depend on primary & secondary consumers (lions ,, tigers)
Weed control To remove unwanted plants
osmosis The tendency of fluids to diffuse in such a manner

DIFFERENCE BETWEEN HABITAT AND NICHE

In ecology, a **niche** is a term describing the relational position of a species in its ecosystem to each other. A definition of niche is how an organism makes living. A niche is the totality of all biological and environmental factors that affect a population. It encompasses everything one can think of that allows populations to live, grow, and reproduce.

The niche of an animal is all the conditions it can tolerate and where it lives. There are two types of niches. A broad and narrow niche. An animal that has a broad niche can tolerate more conditions rather than an animal that has a narrow niche. An example of an animal that has a broad niche is an opposum. An example of an animal that has a narrow niche is a panda bear.

The ecological niche describes how an organism or population responds to the distribution of resources and competitors.

A niche is the functional role of a species in a community—that is, its occupation, or its living. For example, the tanager lives in a deciduous forest habitat. Its niche, its part, is gleaning insects. The community provides the habitat—the place where particular plants or animals live. Within the habitat, organisms occupy different niches.

Habitat - is the specific place where something lives.

Niche - is the role of a specie plays in a community such as feeding relationships, space, and what the organism needs to survive in the environment. It includes how a species uses and affects its environment.

Encompasses - (to enclose within a circle; surround)

Gleaning - To gather (grain) left behind by reapers and to collect bit by bit

Opossums - live in the tree canopies, feeding solely on fruits .

Tanager is a type of bird

Different species of organisms may appear to have the same habitat but each has a different niche so that they can survive in that habitat.

A frog generally tends to have a broad niche. It can live in areas that have little water sources to areas that have a vast region as water sources.

Unit 2-Natural resources

Non-renewable resource

A coal mine in Wyoming. Coal, produced over millions of years, is a finite and non-renewable resource on a human time scale.

A **non-renewable resource** (also known as a finite resource) is a resource that does not renew itself at a sufficient rate for sustainable economic extraction in meaningful human timeframes. An example is carbon-based, organically-derived fuel. The original organic material, with the aid of heat and pressure, becomes a fuel such as oil or gas. Fossil fuels (such as coal, petroleum, and natural gas), and certain aquifers are all non-renewable resources.

Metal ores are other examples of non-renewable resources. The metals themselves are present in vast amounts in the earth's crust, and are continually concentrated and replenished over millions of years. However their extraction by humans only occurs where they are concentrated by natural processes (such as heat, pressure, organic activity, weathering and other processes) enough to become economically viable to extract. These processes generally take from tens of thousands to millions of years. As such, localized deposits of metal ores near the surface which can be extracted economically by humans are non-renewable in human timeframes, but on a world scale, metal ores as a whole are inexhaustible, because the amount vastly exceeds human demand, on all timeframes. Though they are technically non-renewable, just like with rocks and sand, humans could never deplete the world's supply. In this respect, metal ores are considered vastly greater in supply to fossil fuels because metal ores are formed by crustal scale processes which make up a much larger portion of the earth's near-surface environment than those that form fossil fuels, which are limited to areas where carbon-based life forms flourish, die, and are quickly buried. These fossil fuel-forming environments occurred extensively in the Carboniferous Period.

In contrast, resources such as timber (when harvested sustainably) and wind (used to power energy conversion systems) are considered renewable resources, largely because their localized replenishment can occur within timeframes meaningful to humans.

Fossil fuel

Natural resources such as coal, petroleum (crude oil) and natural gas take thousands of years to form naturally and cannot be replaced as fast as they are being consumed. Eventually it is considered that fossil-based resources will become too costly to harvest and humanity will need to shift its reliance to other sources of energy. These resources are yet to be named.

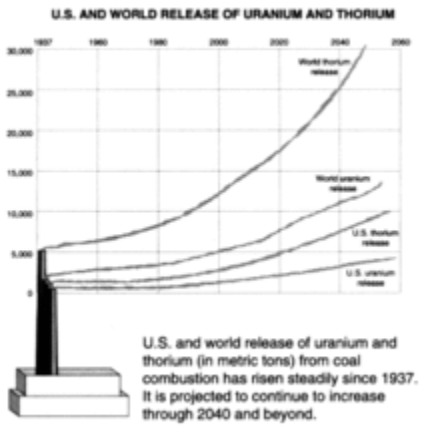
An alternative hypothesis is that carbon based fuel is virtually inexhaustible in human terms, if one includes all sources of carbon-based energy such as methane hydrates on the sea floor, which are vastly greater than all other carbon based fossil fuel resources combined. These sources of carbon are also considered non-renewable,

although their rate of formation/replenishment on the sea floor is not known. However their extraction at economically viable costs and rates has yet to be determined.

At present, the main energy source used by humans is non-renewable fossil fuels. Since the dawn of internal combustion engine technologies in the 17th century, petroleum and other fossil fuels have remained in continual demand. As a result, conventional infrastructure and transport systems, which are fitted to combustion engines, remain prominent throughout the globe. The continual use of fossil fuels at the current rate is believed to increase global warming and cause more severe climate change.[1]

Radioactive fuel

An open pit uranium mine in Namibia



Annual release of uranium and thorium radioisotopes from coal combustion, predicted by ORNL to cumulatively amount to 2.9 million tons over the 1937-2040 period, from the combustion of an estimated 637 billion tons of coal worldwide.[2]

Further information: Uranium depletion

The use of nuclear technology requires a radioactive fuel. Uranium ore is present in the ground at relatively low concentrations and mined in 19 countries.[3] This mined uranium is used to fuel energy-generating nuclear reactors with fissionable uranium-235 which generates heat that is ultimately used to power turbines to generate electricity.[4]

Nuclear power provides about 6% of the world's energy and 13–14% of the world's electricity.[5] The expense of the nuclear industry remains predominantly reliant on subsidies and indirect insurance subsidies to continue.[6][7] Nuclear energy production is associated with potentially dangerous radioactive contamination as it relies upon unstable elements. In particular, nuclear power facilities produce about 200,000 metric tons of low and intermediate level waste (LILW) and 10,000 metric tons of high level waste (HLW) (including spent fuel designated as waste) each year worldwide.[8]

The use of nuclear fuel and the high-level radioactive waste the nuclear industry generates is highly hazardous to people and wildlife. Radiocontaminants in the environment can enter the food chain and become bioaccumulated.[9] Internal or external exposure can cause mutagenic DNA breakage producing teratogenic generational birth defects, cancers and other damage. The United Nations (UNSCEAR) estimated in 2008 that average annual human radiation exposure includes 0.01 mSv (milli-Sievert) from the legacy of past atmospheric nuclear testing plus the Chernobyl disaster and the nuclear fuel cycle, along with 2.0 mSv from natural radioisotopes and 0.4 mSv from cosmic rays; all exposures vary by location.[10] Some radioisotopes in nuclear waste emit harmful radiation for the prolonged period of 4.5 billion years or more,[11] and storage has risks of containment. The storage of waste, health implications and dangers of radioactive fuel continue to be a topic of debate, resulting in a controversial and unresolved industry.

Renewable resources

Natural resources, called renewable resources, are replaced by natural processes and forces persistent in the natural environment. There are intermittent and reoccurring renewables, and recyclable materials, which are utilized during a cycle across a certain amount of time, and can be harnessed for any number of cycles.

The production of goods and services by manufacturing products in economic systems creates many types of waste during production and after the consumer has made use of it. The material is then either incinerated, buried in a landfill or recycled for reuse. Recycling turns materials of value that would otherwise become waste into valuable resources again.

The natural environment, with soil, water, forests, plants and animals are all renewable resources, as long as they are adequately monitored, protected and conserved. Sustainable agriculture is the cultivation of plant materials in a manner that preserves plant and animal ecosystems over the long term. The overfishing of the oceans is one example of where an industry practice or method can threaten an ecosystem, endanger species and possibly even determine whether or not a fishery is sustainable for use by humans. An unregulated industry practice or method can lead to a complete resource depletion.[12]

The renewable energy from the sun, wind, wave, biomass and geothermal energies are based on renewable resources. Renewable resources such as the movement of water (hydropower, tidal power and wave power), wind and radiant energy from geothermal heat (used for geothermal power) and solar energy (used for solar power) are practically infinite and cannot be depleted, unlike their non-renewable counterparts, which are likely to run out if not used sparingly.

The potential wave energy on coastlines can provide 1/5 of world demand. Hydroelectric power can supply 1/3 of our total energy global needs. Geothermal energy can provide 1.5 more times the energy we need. There is enough wind to power the planet 30 times over, wind power could power all of humanity's needs alone. Solar currently supplies only 0.1% of our world energy needs, but there is enough out there to power humanity's needs 4,000 times over, the entire global projected energy demand by 2050.[13][14]

Renewable energy and energy efficiency are no longer niche sectors that are promoted only by governments and environmentalists. The increasing levels of investment and that more of the capital is from conventional financial actors, both suggest that sustainable energy has become mainstream and the future of energy production, as non-renewable resources decline. This is reinforced by climate change concerns, nuclear dangers and accumulating radioactive waste, high oil prices, peak oil and increasing government support for renewable energy. These factors are commercializing renewable energy, enlarging the market and growing demand, the adoption of new products to replace obsolete technology and the conversion of existing infrastructure to a renewable standard.[15]

Economic models

In economics, a non-renewable resource is defined as goods, where greater consumption today implies less consumption tomorrow.[16] David Ricardo in his early works analysed the pricing of exhaustible resources, where he argued that the price of a mineral resource should increase over time. He argued that the spot price is always determined by the mine with the highest cost of extraction, and mine owners with lower extraction costs benefit from a differential rent. The first model is defined by Hotelling's rule, which is a 1931 economic model of non-renewable resource management by Harold Hotelling. It shows that efficient exploitation of a nonrenewable and nonaugmentable resource would, under otherwise stable conditions, lead to a depletion of the resource. The rule states that this would lead to a net price or "Hotelling rent" for it that rose annually at a rate equal to the rate of interest, reflecting the increasing scarcity of the resources. The Hartwick's rule provides an important result about the sustainability of welfare in an economy that uses non-renewable source.

However, nearly all metal prices have been declining over time in inflation adjusted terms, because of a number of false assumptions in the above. Firstly, metal resources are non-renewable, but on a world scale, largely inexhaustible. This is because they are present throughout the earth's crust on a vast scale, far exceeding human demand on all time scales. Metal ores however, are only extracted in those areas where nature has concentrated the metal in the crust to a level whereby it is locally economic to extract. This also depends on the available technology for both finding the metal ores as well as extracting them, which is constantly changing. If the technology or demand changes, vast amounts of metal previously ignored can become economically extractable. This is why Ricardo's simplistic notion that the price of a mineral resource should increase over time has in fact turned out to be the opposite, nearly all metal ores have decreased in inflation adjusted prices since well before the early 20th century. The main reason he was wrong is that he assumed that metals are exhaustible on a world scale, and he also misunderstood the effect of globally competing markets; in human terms the amount of metal in the earth's crust is essentially limitless. It is only in localized areas that metal ores can become depleted, as these local areas compete with extraction costs of resources elsewhere, which does have ramifications for the sustainability of local economies.

UNIT III: BIODIVERSITY
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The word biodiversity is a combination of two words: "*biological and diversity"* and refers to the variety of life on the Earth which include a large number of living things that exist in a certain area (in the air, on land or in water). The area may be considered as small as heap or as big as whole planet. Hence, Biodiversity means " **the existence of a large number of different kinds of animals and plants which make a balanced environment"** (or)
" ***the totality of all species and ecosystems in a region"*** is called as biodiversity. Biodiversity deals with a large variety of flora and fauna on this earth. For eg: a wide variety of plants and animals are find in a part of forest. The plant life range from a small herb to a large tree and the animal life vary from a tiny insect to a large mammal in addition to micro-organisms (algae, bacteria, fungi etc) .
Biodiversity is usually considered at three different levels:
Genetic diversity means the variation of genes within the species. For eg: in human species, genetic variation between an Indian and African and genetic variations within a population (eg: within the Indian population) can be seen . In simple terms, genetic matter dictates whether the persons have blue or brown eyes, brown or black hair and tall or short..
Genetic diversity can be identified by using a variety of DNA based and other techniques. One estimate is that there are 1000 crores of different genes distributed across the worlds biota though they do not all make an identical contribution to overall genetic diversity.
1. Species diversity means the richness of species in all ecosystems. It is measured on the basis of number of species in a region. So far 1.75 million species have been described world wide.
Warmer areas tend to support more species than colder ones and wetter areas contain more species than drier ones. Topography and climate of the areas support and control the species of a region. .
2. **Ecosystem diversity** means the study of difference between ecosystem types. Ecosystem diversity is difficult to measure since the boundaries of various sub ecosystems are overlap each other. An example for ecosystem diversity is Godavari – Delta ecosystem which consists of grassland ecosystem, , river ecosystem, estuarine ecosystem, fresh water aquatic ecosystem, marine water aquatic ecosystem .

Importance of biodiversity: Biodiversity performs a number of ecological series for human kind that have economic, and aesthetic values. As an example, the contribution of biodiversity to human health is given below:
One out of 125 plant species produce a major drug as per Herb Research Foundation. Of the 118 drugs in the US, 74% are based on plants; 18% on fungi; 05% on bacteria and 03% on vertebrates. 80% of the world population relies on traditional plant medicine.
Value of biodiversity: The value of biodiversity (in terms of its commercial utility, ecological services, social and aesthetic values) is enormous. There are several ways that biodiversity and its various forms are valuable to humans. We get benefits from organisms in an innumerable ways. . Sometimes, one realize the value of the organism only after it is lost from this Earth.
Every year numerous species are lost before we have a chance to know anything about them. The biodiversity value may be classified as follows:
1. CONSUMPTIVE VALUE: Biodiversity is an essential requirement for the maintenance of global food supply. The main sources of human food includes animals, fish and plant produces.
A large number of plants are consumed by human beings as food. A few animal species are consumed by people which comes from cattle, pigs, sheep, goats, buffaloes, chickens, ducks, geese and turkey species.
Fish: Many fresh water fish can be grown in ponds. Israel and China already get about half of their fish from aqua culture.
Drugs & medicines: About 75% of the worlds population depends upon plants or plant extracts for medicines. The drug Penicillin used as an antibiotic is derived from a fungus called ***Penicillium.*** Likewise, Tetracycline from a bacteria which is used to cure malaria is obtained from the bark of cinchona tree. .
Fuel: The fossil fuels like coal, petroleum products and natural gas are the products of biodiversity.
2. PRODUCTIVE VALUE: *Some of the organisms* are commercially usable where the product is marketed and sold. The animal products like tusks of elephants; musk from deer; silk from silkworm; wool from sheep or goats; fur of many animals etc all of which are traded in the market.
□□*Calabar bean* was tradionally used as a poison in West Africa.
□□*Daisy plants* were first used as a lice remedy in the middle east and this led to the discovery of *Pyrethrum*. Mosquito coils made from Pyrethrum are sold in the market.
□□The bacterium *Bacillus thuringiensis* produces toxic proteins that kill certain insects.
□□The *neem tree* has been using in birth control such as parts of neem tree that cause abortion.
3. SOCIAL VALUE: These are the values associated with the social life, religion and spiritual aspects of the people. Many of the plants are considered to be sacred in our country like Tulasi, Mango leaves, Banana leaves, . The leaves, fruits, flowers of some of the plants are used in worship.
Many animals like cow, snake, bull, peacock also have significant place in spiritual and thus hold special importance. Thus, biodiversity has distinct social value, attached with different societies.
4. ETHICAL VALUE: The ethical value means that human beings may or may

not use a certain species but knowing the very fact that this species exists in nature gives pleasure. For eg: a peculiar species of Pigeon, grey / white bird with short legs is no more on this earth. Similarly, Dodo species is also no more. Human beings are not deriving anything direct from Kangaroo, giraffe but strongly feel that these species should exist in nature.

5. AESTHETIC VALUE: Every one of us would like to visit vast stretches of lands to enjoy the visible life. People from farther areas, spend a lot of time and money to visit wild life areas where they can enjoy the aesthetic value of biodiversity and this type of tourism is known as eco tourism.

Eco-tourism is estimated to generate 12 billion dollars of revenue annually that roughly gives the aesthetic value of biodiversity.

A study of the impact of environment on the psyche was undertaken by Kaplan and Kaplan (1989) in which they found that being near nature relieved working stresses while people who worked in closed environment or human made structures experienced much more job stresses and illnesses.

India as a mega diversity Nation:

India contains a great wealth of biodiversity in the forests, wet lands and marine areas. Hence biodiversity can be observed at all levels ie locally, nationally and globally . India, as a subcontinent representing a major part of South Asia is rich in flora and fauna and hence it is one of the world's "MEGADIVERSITY NATIONS" . It is estimated that over 75000 species of animals and over 45000 species of plants are found in India. The identified biodiversity in India and world is :

GROUP	**NO OF SPECIES IN INDIA**	**NO OF SPECIES IN WORLD**
Mammals	350	4629
Birds	1224	9702
Reptiles	408	6550
Amphibians	197	4522
Fishes	2546	21730
Flowering plants	15000	250000

Biogeographic regions of India: According to **wild life Institute of India**, the country has 10 distinct biogeographic zones or regions. They are:

1. Trans – Himalayan Zone
2. Himalayan Zone
3. Desert Zone
4. Semi – arid Zone
5. Western Ghats
6. Deccan Zone
7. Gangetic plain Zone
8. NE Indian Zone
9. Coastal Zone
10. Islands around the country.

Endangered and Endemic species:

Endangered species A species whose numbers are reduced to the point. That means endangered species are in immediate danger of extinction. The International Union Conservation of Nature (IUCN) classified the species of plants and animals as:

(a) Endangered species
(b) Vulnerable species means depleted species.
(c) Threatened species: Species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future)
(d) Rare species

Among the important endangered animal species, Indian wild ass; the Kashmir stag, the Golden Langur etc .. are considered highly endangered. There are also endangered bird species like Siberian crane; the great Indian Bustard; the florican etc..

The IUCN published the data on endangered species of both plants and animals of India. The data symbolizes the working signal for those species which are endangered and if not protected are likely to become extinct in near future.

India contains 172 species of animal are considered to be endangered; vulnerable; rare and threatened. These include :

TAXANOMIC GROUP
Endang
ered sp
Vulnerable
species
Rare
species
Threatened
species
Un
known
TOTAL
MAMMALS
(Tiger; Leopard; Indian Lion;
Golden cat; Desert cat;
Sloth bear; Red fox;
Indian wolf; golden monkey;
Lion tailed Macaque)
13 20 2 5 13 53
BIRDS (Siberian white
crane; Vultures; Great Indian
Bustard; peacock; pelican)
6 20 25 13 5 69
REPTILES (Gharial; green
sea turtle; star tortoise;
python)
6 6 4 5 2 23
AMPHIBIANS 0 0 0 3 0 3
FISHES 0 0 2 0 0 2
INVERTIBRATES (crab;
beetle; spider; snail)
1 3 12 2 4 22
26 49 45 28 24 172

During the recent past, Vultures which were common have suddenly

disappeared. Several species of Reptiles (lizard; snakes; star tortoise; crocodiles); ; Amphibians (frog); Invertebrates (crab, beetle; spider; snail) are also threatened due to human anthropogenic activities.
India contains some of Asia's rarest animals such as: The Bengal Fox; Asiatic Cheetah; Marbled Cat; Asiatic Lion; Indian Elephant; Asiatic wild Ass; Indian Rhinoceros; Markhor; Gaur; Wild Asiatic Water Buffalo etc…
Description of the Asiatic Lion (Panthera Leo Persica): The Asiatic Lion is very similar to the African Lion. The lion is yellowish brown in color. The male lion is distinguished by the presence of the **mane**. The lion on an average grow to about 9 feet in length. The young cubs (young lions) are often spotted or striped. Though the Asiatic lions are once widespread throughout SW Asia (Northern Greece to Central India) their numbers declined with the disappearance of grasslands. Today the Asiatic Lion is restricted to GIR National Park, Gujarat, India and the total population of the Asiatic Lion is around 250 only The effort to conserve this species was initiated as long ago as 1910 by the Nawab of Junagadh who banned the hunting of lions within his province. Emperor Ashoka used the Lion as a symbol of Power & Strength.
Endemic Species is a species that confined to a certain region and are restricted to particular areas. Eg: Penguins usually found on a single ice-land or glaciers. About 33% of the country's flora (plants) are endemic and are concentrated mainly in :
NE part of India (Rhinoceros is restricted to Assam but was once found throughout the Gangetic plain)
Western Ghats (Lion – tailed macaque & Nilgiri leaf monkey and bull frog; tree frog)
NW and Eastern Himalayas (Oak tree; Pine tree; Hangul deer of Kashmir ; snow leopard; jackal; wild dog; Himalayan wolf)
Andaman and Nicobar islands and South India (Nilgiri Tahr is found in Nilgiri & Annamalai hills in south India)
The Gangetic plains are generally poor in endemics while the Andaman & Nicobar islands are rich.
Hot spots of biodiversity: Biologically hot spots are areas that are extremely rich in endemic species of both plant and animals.
The world is identified with 25 biodiversity hot spots containing 44% of all plant species and 35% of vertebrates & 21% of invertebrates and others of all animal species in land area. The following is the list of identified bio-diversity hot spots of the world:
S No Location S No Location
1 **Tropical Andes** (venezula; Columbia; peru; argentina)
14 Mediterranean Basin (surroundings of Europe, Asia; Africa; Algeria; Libya; Egypt)
2 Meso America (central Mexico) 15 Caucasus
3 Caribbean (West Indies) 16 Sunda land
4 Brazil forest 17 Wallacea
5 Western Ecudor (NW of S.America)
18 Philliphines

6 Brazil's Cerrado 19 Indo-Burma region
7 Central Chile 20 South Central China
8 California Province 21 Western ghats – Sri Lanka
9 Madagascar 22 SW Australia
10 Coastal Forest of Kenya (S Africa) 23 New Caledonia
11 Western African Forests 24 New Zealand
12 Cape Province (S. Africa) 25 Polynesia / Micronesia
13 Karoo (Australia)

Hot spots in India: Among 25 hot spots of world two found in India extending into neighbouring countries viz., 1) The Western Ghats – Sri Lanka region and 2) The Indo – Burma region covering Eastern Himalayas (The Eastern Himalayas form a distinct region which comprises Nepal, Bhutan ; Sikkim and states of Northern India).

PLANTS OF ENDEMIC SPECIES*:* Of India's 45000 plant species, 1600 endemics are found in a 17000 sq kms in the Western Ghats. In Sikkim, in an area of 7298 sq kms, 4250 plant species are endemic while in Nepal, 500 species are believed to be endemic . Bhutan possesses an estimated species of 750 are considered to be endemic. Eg; oak tree; pine tree etc..

ANIMALS OF ENDEMIC SPECIES: Eg: Penguins . Rhinoceros (NE of India); Lion – tailed macaque & Nilgiri leaf monkey and bull frog; tree frog (Western Ghats) Hangul deer of Kashmir ; snow leopard; jackal; wild dog; Himalayan wolf (NW and Eastern Himalayas); Nilgiri Tahr (Nilgiri & Annamalai hills in south India).

Major threats to the Biodiversity:

Biodiversity is threatened by anthropogenic activities in many ways (by destruction of forests, over – hunting conversion of wet lands & grass lands into industrialization; mining of minerals / rocks; pollution; constructions of roads; tourism business; exploitation of timber resources etc..) to eliminate millions of species. Habitat loss is the major cause of species extinction. Habitat loss may be qualitative and quantitative losses:

Qualitative losses involve a change in the structure, function or composition of the habitat. Eg: If a paper industry discharging chemicals into a waterway system and polluting / poisoning the water, thus there has been a qualitative loss.

Quantitative losses is measured by looking at a previously mapped area and determining how much of the habitat area is no longer present. Eg: If a wet land is paved over, then there has been a quantitative loss of wet land.

Diseases; The spread of non – native species threatens many local species with extinction (eg: Dodo); climate changes (threatens to force species and ecosystems to migrate towards favourable areas) etc disturb and cause the elimination of species. .

Biogeographical classification of India: India is the 7th largest country in the world and Asia's second largest nation with an area of 32,87,263 sq km. It has a land frontier of 15,200 kms and a coast line of 7516 km. India's northern frontier's are Tibet; China; Nepal and Bhutan. In the North West, India borders on Pakistan ; in the Northeast China and in the East, Burma. The southern peninsula extends into Indian Ocean; Bay of Bengal lying to the Southeast and the Arabian Sea to the Southwest.

For administrative purposes India is divided into 28 states and 7 union territories. Physically the country is divided into four relatively well defined regions:

a) Himalayan region

b) The Gangetic river plains or Indo-Gangetic plains.
c) The southern (Deccan) Plateau and
d) The islands of Lakshadweep, Andaman and Nicobar.
The Himalayas in the North include the highest peaks in the world. The highest mountains are:
a) Khanchen Junga (8586 mts) which is located in Sikkim;
b) Pir Panjal (3,600 – 4,600 mts) in Kashmir;
c) Dhaula dhar in Himachal Pradesh and
d) Siwaliks (900 – 1500 mts) in the Indo – Gangetic plains.
The northern plains of India stretch from Assam in the East to the Punjab in the West covering a distance of 2400 kms. Some of the largest rivers in India including the Ganges, Ghaghara, Brahmaputra and Yamuna flows across this region.
Thar desert which is located at the western extremity of Indian part of the plains in the states of Rajasthan. Observations show that the biodiversity is far richer in NE Himalayan range compared to Northwest range. The following factors play a major role in the classification of biogeographical / biodiversity:
CLIMATE: The climate of India is dominated by the Asiatic monsoon, mostly by southwest rains between June and October and drier winds from the North between December and February. From March to May the climate is dry and hot. .
WET LANDS: India has a rich variety of wetland habitats. The total area of wetlands excluding rivers in India is 5,82,86,000 hectares . Chilka lake (orissa) and Keoladeo National Park (Bhartpur in Rajasthan) have been designated under the convention of wetlands of International importance. The country's wet lands are generally differentiated by region into 8 categories:
1. The reservoirs of the Deccan Plateau in south
2. the vast saline expanses of Rajasthan and Gujarat
3. Fresh water lakes and reservoirs from Gujarat eastwards.
4. The delta wet lands and lagoons of India's east coast.
5. The fresh water marshes of Gangetic plain
6. The Flood plain of Brahmaputra
7. The marshes and swamps in the hills of NE India and Himalayan foot hills and the lakes and rivers of the mountain region of Kashmir and Ladakh and
8. Wet lands of the island areas of Andaman & Nicobars.
FORESTS: The panorama of Indian forests ranges from evergreen tropical rain forests in the Andaman and Nicobar Islands ; the Western Ghats to alpine forests in the Himalayas to the North. The country has also several types of forests viz.,
a) semi – ever green rain forests
b) Deciduous forests
c) Thorn forests
d) Pine forests
e) Tropical forests (Andaman & Nicobar islands; the Western Ghats)
f) Rain forests (Orissa)
g) Western Ghats monsoon forests contain rosewood, Malabar, teak .
h) Tropical evergreen rain forests and tropical monsoon forests (Andaman & Nicobar)
MARINE ENVIRONMENT: The coastal waters of India are extremely rich in fishing grounds. In 1981, it was estimated that there were approximately 1,80,000 non – mechanized boats carrying out fishing activities in these waters. At the

same time, there were about 20,000 mechanized boats operating mainly out of ports in the states of Maharashtra, Kerala, Gujarat, Tamil Nadu and Karnataka. Indian coral reefs have a wide range of resources which are of commercial value. Exploitation of corals, coral debris is widespread on the Gulf of Mannar and Gulf of Kutch. Ornamental shells and pearls are the important reef industry. Other marine areas are include sea grass and prawns. Five species of marine turtle occur in Indian waters.

1. Green turtle
2. Logger head
3. Olive Ridley
4. Hawksbill
5. Leather back.

Conservation of Biodiversity: In order to maintain and conserve biodiversity, the Ministry of Environment and Forests, Govt of India has already taken several steps to manage wildlife, the objectives of swhich are:

1. Maintenance of a number of species in protected areas such as National Parks, Sanctuaries..
2. To improve the biosphere reserves
3. Implement strict restrictions of export of rare plants and animals
4. Educate the public on these through the Govt agencies and NGO's.

Conservation of biodiversity can be carried out in two ways, as shown:

In-situ conservation: The preservation of species in its natural ecosystem is called in-situ conservation. As a consequence, protected areas are being identified and maintained for natural conservation of species by individual countries. For the conservation and management of endangered species several projects have been established. These are:

Tiger Projects: Corbett National Park which is 300 km from New Delhi is the oldest National Park of India having 1318.54 sq km. It was one of the nine Tiger Reserves created at the launch of the Project Tiger in 1973. The original area of the Park was 323.75 sq. km. to which 197.07 sq. km. was added later. An area of 797.72 sq. km. was added as buffer of the Corbett Tiger Reserve in 1991.

Conservation of Biodiversity

In-situ conservation Ex-situ conservation

National Parks

Wild life sanctuaries

Home gardens,

sacred gardens

Seed bank

Genes Bank

Botanical gardens ; Zoological garden ; Aquariums

Gir Lion Projects: The Gir Forest of Gujarat where lions are found. This has an area of 1412 sq kms and declared as a National Park.

Elephant Projects: The objective was to ensure long-term survival of population of elephants (not come into operations).

Project Elephant (PE), a centrally sponsored scheme, was launched in February 1992 to provide financial and technical support to major elephant bearing States in the country for protection of elephants and their habitats. The Project is being

implemented in 13 States/UTs, viz..Andhra Pradesh, Arunachal Pradesh, Assam, Jharkhand, Karnataka, Kerala, Meghalaya, Nagaland, Orissa, Tamil Nadu, Uttranchal, Uttar Pradesh and West Bengal.

There are about 7000 protected areas in the world which include a variety of National parks, Sanctuaries etc which vary in size (between 100 to 500 sq km), purpose (protection of one or more species and their habitats).. In India, there are 39 National Parks and 492 wildlife sanctuaries.

National Parks : These are protected areas exclusively for wild life. Human activities like hunting , Firewood collection, timber harvesting etc… are restricted in these areas to that wild plants and animals could grow in a protected environment.

S.
No National Park State Wildlife varieties

1 Kaziranga National Park Assam **One horned Rhinoceras**; Wild buffalo; sambhar; gibbon; pelican bird.

2 Sundarban National Park West Bengal Tiger; Gangetic dolphin; crocodile

3 Hazaribagh National Park Bihar Wild bear; Gaur; Sambhar, Nilgai, Chital; Sloth bear

4 Corbett National Park U P **Tigers** Python, king cobra; chital; nilgai; elephants

5 Gir National Park Gujarat Asiatic Lion Panther, Hyna; Sambhar; Chinkara; Langur (leaf monkey) ; green pigeon

6 Kankha National Park M P Tiger, Panther; chital; Blue bull; four horned deer; Black buck; wild dog; grey horn bill

7 Tandoba National Park Maharashtra Langur; Bison; Chital; Blue bull; Tiger; Sambhar

8 Bandipur National Park Karnataka Elephant; gaur; Malabar squirrel; wild dog; slothbear; green pigeon

9 Desert National Park Rajasthan Great Indian Bustard; Black buck; Chinkara

Wildlife sanctuaries: It is an area for the conservation of animals only. Timber collection, Collection of forest produces and private ownerships are allowed subjected to condition that such activities shall not affect the animals.

S.
No Wildlife sanctuary State Wildlife varieties

1 Indira Gandhi Wild life Sanctuary Tamil Nadu Elephant; tiger; guar; sambhar; spotted deer; sloth bear; wild dog; barking deer

2 Jaldapara Sanctuary West Bengal Rhinoceros; leopard, guar, deer, sambhar, **various birds**;

3 Keoladeo Ghana Bird Sanctuary Rajasthan Siberian crane; herons; spoon bill;

various famous birds
4 Sultanpur Lake Bird
Sanctuary
Haryana Crane, sarus, spots bill, duck drake,
python
5 Nagarjuna Sagar
Sanctuary
A P Tiger; panther; wild bear; chital; nilgai;
black buck; fox; jackal; wolf; crocodile
6 Chilka Lake Bird
Sanctuary
Orissa Water fowls, ducks, cranes, ospreys,
golden plovers, sandpipers
Ex-situ conservation is the maintenance and breeding of endangered plants and animal species under certain conditions and locations. It refers to conservation of species in suitable locations outside their natural habitat.
In this method, the animal species are put in zoological parks and plants in Botanical gardens to multiply under artificial conditions. Eg: Crocodile Breeding at Madras; Pygmy Hog breeding in Gauhati; Manipur Brown Anti-red deer at Delhi Suitable locations in field for Ex-situ conservation are:
Botanical / Zoological gardens; **aquarium** and **research centres**
Field gene banks: Growing plants have been assembled
Seed bank: plants seeds are suitable for long term storage.
In vitro (in glass): buds; stem tips are kept under low temperature ie -3o C to 12o C
Census
Wild Species 1993 1994 1995 1996 1997
Tiger 123 128 134 -- 138
Panther 100 102 110 -- 109
Elephant 417 -- 502 -- 746
Cheetal 36525 -- 31919 -- --
Sambar 5576 -- 5695 -- 5757
Barking Deer 2262 -- 2271 -- 2229
Hog Deer 292 -- 294 -- 477
Bear 54 -- 58 -- 40
Wild Boar 7670 -- 7711 -- 7906
Ghariyal 224 -- 123 -- 283
Mugar 118 -- 119 -- 301
Ghoral 424 -- 433 -- 451
Monkey 12663 -- 12574 -- 12764
Langur 14091 -- 14187 -- 14300
BIODIVERSITY (UNIT - III)
Aesthetic Understanding of beautiful things
Algae Very simple plants that grow in or near water
Alpine High mountains
anthropogenic Related to human beings
Aqua culture The process of growing things for scientific purpose
Bark The outer covering of a tree
Biological Process that take place within the living things
Cattle Cows & bulls

convention Becomes usual
Corals A hard usually pink or white substance produced by a small sea animal.
Cubs A young bear, fox , lion etc.
Daisy plants A small wild flower with white petals
decidous Trees having leaves that fall in a season.
degradation Made worse or the process of being damaged
Depiction To represent something on the picture
destruction Damage
Distinct Clearly seen
Diversity A range of many people or things that are very different from each other
DNA (De-oxyribo Nucleic Acid)
a chemical in the cells of animals and plants that carries genetic information.
Domino effects A situation in which one event causes a series of similar events happen one after the other
Endangered A species whose numbers are reduced to the point i.e., in danger of becoming extinct
Endemic species Species that are found in a single locality or area and no where else in the world
European countries Austria; Bulgaria; Denmark; England; Finland; Greenland; Iceland ; Serbia; Sweden
Expanses A large open area of land or sea or sky
Feral animals Wild animals especially after escaping from life
Folk Traditional style of dance
Foxglove A tall plant with purple flowers growing on its stem
Frontier A line that separates two countries
Fungi A type of plant without leaves & without green color gets its food from other living / dead / decayed things.
Gene A unit inside a cell which controls a particular quality in a living thing that has been passed on from its parents.
Goose A bird like a large duck
Habitat The place where a particular type of animal or plant is normally found
Heap Used to describe a spoon
Herb A plant whose leaves / flower / seeds used in medicine or to flavor the food.
invasion Disturbing
Lagoon A lake that contains sea water
Mane The long, thick hair that grows on the neck of animals
Mangroove A tropical tree that grows in mud and has roots that are above the ground
Marshes An area of soft wet land
Microorganisms Algae, Bacteria, Fungi, Protozoa
Musk A substance with strong smell used in making perfumes
Paved A path is covered by flat stones.
Psyche Deepest feelings

Pine trees Several kinds of evergreen trees with cones and needle like leaves.
Rare species Small in size (population) in the world
Sacred Connected to god
Semi-arid Having little or no rain
species A group into which animals , plants that are able to breed with each other and produce healthy young.
Swamps An area of very wet
Threat Punishment or harm to biodiversity
Threatened species may become endangered if corrective action is not taken.
Trans Beyond into another place
Tropical Hot
Turkey A large bird ie kept for meat
Tusk A long curved teeth
Vulnerable Easy to hurt or emotional

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UNIT – IV: POLLUTION

Contents:

INTRODUCTION: According to ODUM (1971), Pollution is ***"an undesirable change in the characteristics of air, water and land that harmfully affect the life and also create health hazards for all living organisms on the globe"***.

According to SOUTHWICK (1976), Pollution can be defined as ***" the unfavorable (or) alteration of environment caused by human activities and causing harm to human beings ".***

Basically the Pollution is of two types viz.,

(1) Natural Pollution: This type of pollution is limited in its occurrence generally from natural hazards like volcanic eruptions, emissions of natural gas, soil erosion, ultraviolet rays, cosmic rays etc and

(2) Man made Pollution: Most of the pollution is man made only. .

However, Pollution is usually categorized as Air Pollution; Water Pollution; Thermal Pollution; Noise Pollution; Land & soil Pollution; Radio Active Pollution and Marine Pollution .

AIR POLLUTION

Air pollution may be described as " ***the imbalance in quality of air so as to cause adverse effects on the living organisms existing on earth***" . Pollution is due to the presence of undesirable substance of sufficient quantity which exists in environment. ***The substance or energy which causes pollution is called pollutant***. Pollutants may be classified according to origin and state of matter.

a) According to Origin: Air pollutants are divided into two categories as primary & secondary. Primary air pollutants are those which are emitted directly into the atmosphere. Eg: C; CO; CO2; SOx ; N; S; H; NOx; CFC's etc . Secondary air pollutants are those which are produced in the air by the interaction among the primary air pollutants or by reaction with atmospheric constituents. Eg: **Ozone (O3)**; **Smog; Para Acetyl Nitrate (PAN)**; **Acid Rain** ; **Aerosols.**

b) According to State of Matter: Air pollutants include fine solids; liquids and gases. Dust, Smoke, Fumes etc are examples for solid particles whereas fog is an example for liquid particles. Benzene (C6H6), Methane (CH4), Butane, Aldehydes, Ketones, inorganic gases etc are gaseous air pollutants. Listed below are the major air pollutants:

SNo

Compound Pollutants

1 Carbon oxides Carbon Monoxide (CO); Carbon dioxide

2 Sulphur oxides Sulphur dioxide (SO2); Sulphur Trioxide (SO3)

3 Nitrogen oxides NO2; Nitrous oxide (N2O); Nitrogen Peroxide (N2O5)

4 Organic compounds Methane; Propane (C3 H8) ; Benzene; Chloro Fluro Carbons (CFC)

5 Photochemical Oxidants Ozone (O3); PAN; Aldehydes

6 Radio active substances Iodine 131; Strontium 90; Plutonium 239

PRIMARY POLLUTANTS:

Carbon Monoxide: It is a colorless, odorless, poisonous gas that is produced by the incomplete burning of carbon based fuels (coal, petrol, diesel and wood) which comes from the automobile industries, exhaust devices, About 70% of CO emissions are from the transport sector.

When the air is polluted with CO, human blood is likely to be deprived of oxygen and leads to coma and death. In mild dosages, it leads to headache .

Oxides of Sulphur: SO2 is a gas produced from burning of coal, mainly in thermal power plants. Some industries such as paper mills produce SO2. It is injurious not only to men and plants, but it also attacks rapidly a few rocks such as limestones, marbles, electric contacts etc. It can even dissolve nylon. Paper absorbs SO2 causing the paper to become brittle and fragile. SO2 polluted air leads to corrosion of metals such as Fe, Zn, Cu, steel etc… SO2 is a major contributor to Smog and acid rain.

Sulphur trioxide is more irritant than SO2 because it combines immediately with water to form sulphuric acid.

Oxides of Nitrogen : Combustion of coal, oil, natural gas and gasoline which produces upto 50 ppm of Nitrogen. NOx are also produced when fossil fuels are burned especially in power plants and motor vehicles. NO2 poisoning results SILOFILTER disease. High levels of NO2 exposure causes cough and make

the human beings feel short of breath. People who are exposed to NO2 for a long time have a higher chance of getting respiratory infections.

NOx compounds contribute for the formation of Ozone. Similarly, when nitrogen oxide when combine with SOx to form acid rain.

Chloro Fluoro Carbons: CFC's (also known as Freon) are non- toxic. They contain Carbon, Fluorine and Chlorine atoms.The Five main CFCs are the following:

□□CFC – 11 (Trichloro Fluoro Methane CFCl3)
□□CFC – 12 (Dichloro Fluoro Methane CF2Cl2)
□□CFC – 113 (Trichloro Trifluoro Ethane C2F3Cl3)
□□CFC – 114 (Dichloro Tetrafluoro Ethane C2F4Cl2)
□□CFC – 115 (Chloropenta Fluoro Ethane C2F5Cl)

The major uses of CFCs are as coolants in refrigerators and in air conditioners; as solvents in cleaners particularly for electronic circuit boards etc.. CFCs are the main cause of ozone depletion. CFCs have a lifetime in the atmosphere of about 20 to 100 years, and as a result one free chlorine atom from a CFC molecule can do a lot of damage.

SECONDARY POLLUTANTS:

Ozone (O3) / Ozone layer Depletion : Ozone consists of oxygen molecules which contain three oxygen atoms. It is not emitted directly into the air but produced in the atmosphere when oxygen combine with oxygen radical (O) in the presence of sunlight. Ozone protects us from ultra violet radiation and other harmful rays.

It is observed that over the last few years, many man made processes release gases into atmosphere causing drastic depletion of ozone layer. The chlorine atoms cause depletion of ozone slowly and holes are formed in the ozone layer.

Ozone reacts with tissues and cause for breathing and decrease the working ability of the lungs, chest pains and coughing. It lowers the human body resistance power and leads to cold; pneumonia also.

Antarctic Ozone depletion: According to NIMBUS-7 satellite picture which was taken on 5th Oct 1987 , the protective ozone layer showed a hole over 50% of the area of the Antarctica continent covering 7 million sq km.

On Jan 1st 1989, the country Montreal (Canada) proposed redesigning refrigeration, air conditioning technology replacing the use of CFCs by ozone friendly substitutes.

Smog: Smog is a combination of smoke and fog or various gases when react in the presence of sunlight. The effects of smog on human health cause for respiratory, irritation to the eyes, diseases related to nose, throat, bronchitis, pneumonia, headache, nerves, liver, kidneys.

The first smog related deaths were recorded in London in 1873, when it killed 500 people. In 1892, December, London had worst experiences causing 1000 deaths. In 1940's severe smog began covering the cities of Los Angeles in USA.

Para *Acetyl Nitrate (PAN):* PAN which is a harmful chemical form in nature and causes irritation of eyes and other human sense organs. It may also cause blisters on the skin.

Acid rain: Acid rain has become one of the most important global environmental problems and poses significant adverse impact on soils, rivers, lakes, forests and monuments. The phenomenon occurs when SOx and NOx from the burning of fossil fuels such as Petrol, Diesel, Coat etc combine with water

vapour in atmosphere and fall as rain or snow or fog.
Natural sources like volcanoes, forest fires, etc also contribute SOx and NOx.
Increased urban and industrial activities cause air pollution resulting in the rise of concentration of SO2 and NOx. Sulphur dioxide and NO2 combines with water vapour in the atmosphere produce sulphuric acid and Nitric acid respectively and results acid rain. Some of the examples are:
Europe and parts of W Asia have experienced rain with water pH range of 4.5 to 5.0 (acidic) in 1958.
In 1962, acid rain occurred in Sweden with pH of water ranging from 4.5 to 5.0.
Netherlands and Holland also experienced acid rains in the same year.
In April 1984, acid rain occurred in Scottland.
Aerosols: These are Suspended Particulate matter. It consists of dust, soot, asbestos particles, Pb, Ni, Nitrate and sulphate salts, fumes, mists, smoke and sulphuric acid particles etc.. These particles measure less than 1 micron in size because of that, they directly enter into respiratory track. Exhaust gases from aero planes, automobile industries are the main sources for releasing aerosols.
Air pollution effects; Prevention & control measures:
Human beings breath 22000 times a day on the average, inhaling 16 kg of air. Atmosphere constitutes a protective cover of gases surrounding the earth which sustains life and saves it from unfriendly environment. The atmosphere consists of several layers viz. Troposphere, Stratosphere; Mesosphere; Thermosphere & Exosphere. The lower atmosphere ie., the troposphere contains 70% of gaseous components of major, minor and traces. Table depicts the available components in the atmosphere as:

Component	Symbol	Concentration in Volume%	Status
Nitrogen	N2	78.09	Major
Oxygen	O2	20.94	Major
Argon	Ar	00.93	Minor
Carbon dioxide	CO2	0.0318	Minor
Ne,He,Kr,H2, CO, O3			Traces
NH3; NO2, SO2; H2S, Xenon etc are still in traces.			

Ultra violet radiation from the sun is absorbed by ozone in the stratosphere which is so called ozone layer located between 17 - 26 kms above sea level.
Effects of Air pollution: The effects of pollution may be direct and affect certain organisms. The effects of pollution may posses a hazard or nuisance. Long continued pollution even effects the evolution of a species and eliminate organisms who cannot tolerate certain pollutants and favour others who can eat.
Air pollution causes deaths, Impair health, reduce visibility, brings vast economic losses. It can also cause intangible losses to historic monuments such as Taj Mahal. Finally, Air pollution can affect the environment on a global scale.
Prevention and control of Air Pollution:
□□Inputs that do not contain the pollutants.
□□Operating process to minimize generation of the pollutants.
□□Replacing the process with one does not generate the pollutant.
□□Removing the pollutants from the process.
□□Substitution of raw materials.
Eg: The substitution of high sulphur coal with low sulphur coal in power plants.
Eg: Changing a fossil fuel with nuclear energy can eliminate sulphur emission.
□□By involving the Process Modification:

Eg: Chemical and petroleum industries have changed by implementing automated operations, computerized process control by reducing the oxidation of SO2 to SO3 by reducing excess air.

□□By involving the control technologies:

Control equipment viz., Wet Collector (scrubber) ; Gravity Settling chamber; Cyclone Collectors; Dry Scrubbers; filters etc.. are to be used to minimize the air pollution.

Water pollution

Hydrosphere in the universe contains water in the form of oceans, rivers, lakes, tanks and many other water sources. Water sources in the world are of two types. They are (1) Marine water bodies and (2) Fresh Water bodies. Water is a good solvent for many substances. Because of this property water cannot exist in its pure form at many parts of the world. Water pollution is mainly because of sewage, industrial disposals ie., effluents ..

Chemical examination of water (tests): pH; Biological Oxygen Demand,; Dissolved Oxygen; Chemical Oxygen Demand etc are some of the chemical tests to find the stage of pollution of water.

pH: The value of pH gives the degree of acidity or alkalinity of polluted water. Determination of pH is important in calculating the coagulant (thick or thin) dose.

Biological Oxygen Demand (BOD): It is defined as the quantity of oxygen utilized by micro organisms at a temperature of 20oC, generally measured for 5 days. when water is polluted by unwanted materials, naturally the O2 content gets reduced and that water become not fit for consumption either by human beings or animals or plants.

Living organisms require water with some quantity of sustainable oxygen in it. That oxygen is necessary for living organisms is generally called ***BOD***. If there is reduction in oxygen content of water, it becomes unfit for biological consumption because there is change in BOD.

Dissolved O2: The amount of oxygen in dissolved form in water at a particular temperature and atmospheric pressure is known as dissolved Oxygen. In polluted waters, dissolved oxygen is the factor which determines whether the biological changes are carried by aerobic (needing oxygen) or by anaerobic (oxygen not required) micro-organisms. Eg: 5 to 8 mg/L of dissolved oxygen is required for most of the species and fishes.

Chemical Oxygen Demand (COD): This test is conducted to determine the pollution strength of the sewage. Potassium dichromate and potassium permanganate are used as oxidizing agents.

Common types of water pollutants:

Disease causing agents: Bacteria, viruses, protozoans that enter water from domestic sewage and animal wastes.

Water soluble inorganic chemicals: Acids, salts and compounds of toxic metals such as Pb, Hg can make water unfit to drink, harm fishes and other aquatic life. Also Nitrate, Phosphate compounds dissolve in water that can cause excessive growth of algae, which then die and decay, depleting dissolved O2 in water and killing fish.

Water Soluble Organic chemicals: Oil, gasoline (a type of oil is obtained from petroleum), pesticides, detergents and many other water soluble chemicals that threaten human health and harm fish.

Heat: Large quantity of water is heated when it is used in the cooling towers of

thermal power plants. When this hot water is discharged into the nearby water bodies, it causes an increase in its temperature.

Sewage: sewage is waste water from municipal area where there is human habitation. Sewage which comes from homes is called ***domestic sewage***.

Fig depicts the water is being polluted by various factors:

Domestic sewage Radioactive elements
Oils Industrial effluents
Silt Pesticides
Virus
Herbicides Fertilizers
Planktons
Toxic Metals Temp Bacteria

WATER

In nature water pollution is classified into three types by Kimball (1975). They are:

1. Domestic water pollution: Sewage is a part of domestic water pollution. Domestic sewage not only contains unwanted waste materials, but it is also infested with harmful bacteria, virus etc. These are responsible for causing diseases in animals and human beings, if they drink this polluted water and even plants may die if polluted water is provided.. Domestic water pollution leads to Diarrhea, Cholera, Typhoid etc in human beings.

2. Agricultural Water Pollution: Water require for plants for its growth. Major irrigation, minor irrigation, sprinkler irrigation, drip irrigation, lift irrigation carry waste substances and causing water pollution in addition to the utilization of fertilizer and pesticides. Agricultural water pollution leads to Eutrophication & Water Bloom.

Eutrophication is the ecosystem response to the addition of artificial or natural substances, such as nitrates and phosphates, through fertilizers or sewage, to an aquatic system. Eutrophication also occurs when fresh water bodies like ponds, lakes, pools which contain organic waste material. Because of that, the fresh water ponds and lakes get polluted. Eutrophication is a type of water pollution. Eutrophication was recognized as a pollution problem in European and North American lakes and reservoirs in the mid-20th century. Since then, it has become more widespread. Surveys showed that 54% of lakes in Asia are eutrophic; in Europe, 53%; in North America, 48%; in South America, 41%; and in Africa, 28%.

Ecological effects: The important troubling ecological impacts are :

□□Excessive nutrients in water bodies promote plant growth which leads to a drop in water quality;
□□Disruption of the natural ecosystem E.g. lack of oxygen for shellfish and marine life (causing a drop in their population).
□□Decrease in the recreational and aesthetic value of water bodies
□□Health problems when it occurs in drinking water reserves
□□Coral reef decline
□□Decreased biodiversity,
□□Changes in species composition and dominance, and
□□Toxicity effects.
□□Toxic phytoplankton species
□□Decreases in water transparency (increased turbidity)
□□Colour, smell, and water treatment problems
□□Dissolved oxygen depletion
□□Increased incidences of fish kills

□□Loss of desirable fish species

Water Bloom is defined as "A growth of algae at or near the surface of a body of water, such as a pond". This is another kind of water pollution because of the presence of Blue Green Algae (BGA).

Blue-green algae are microscopic organisms that can be considered as simple aquatic plants that occur naturally in habitats such as marine waters, rivers, lakes, damp soil, tree trunks, hot springs and snow. They can vary considerably in shape, colour and size.

They usually are present in low numbers. Blue-green algae can become very abundant in warm, shallow, undisturbed surface water that receives a lot of sunlight. When this occurs, they can form blooms that discolor the water or produce floating rafts or scums on the surface of the

Because of the presence of B G A, the water turns blue in color or blue green which is unsuitable for drinking. This type of pollution of fresh water bodies by Blue Green Algae is generally called "***Water Bloom***".

3. Industrial water pollution: Many industries discharge waste materials containing harmful chemicals. Such Industrial wastes are called ***effluents***. Rivers get polluted when the river water is polluted by mixing of chemical substances released by the petrochemical industries, paper industries, chemical industries etc. The river Godavari is polluted because of effluents released by the paper industry. It effects the entire water ecosystem causing enormous damage to fishes, prawns and fresh water animals. Eg: Minimita disease & Fluorosis.

Minamata disease is a neurological syndrome caused by severe mercury poisoning. Symptoms include ataxia, numbness in the hands and feet, general muscle weakness, narrowing of the field of vision and damage to hearing and speech. In extreme cases, insanity, paralysis, coma, and death follow within weeks of the onset of symptoms.

Minamata disease was first discovered in Minamata city in Japan in 1956. It was caused by the release of methyl mercury from, the Chisso Corporation's chemical factory, which continued from 1932 to 1968.

This highly toxic chemical bio- accumulated in shellfish and fish in Minamata Bay which when eaten by the local populace resulted in mercury poisoning. While cat, dog, pig, and human deaths continued over more than 30 years, the government and company did little to prevent the pollution.

Fluorosis: People suffer from a disease called fluorosis after consuming water containing fluorine for sufficiently a long time. Quantity of fluoride in water is only 1 ppm. Diseases caused by fluorosis are:

□□Back pain and cannot easily bend.

□□Joints get stiffened as so movement of joints is impaired.

□□Teeth are the worst effected and a brown coating appears on the enamel of teeth giving bad appearance.

□□Persons with fluorosis cannot erect freely.

Preventions or control measures of water pollution:

1. Drinking water should be boiled, cooled and then used.
2. Disinfection of drinking water should be done by using chemicals like bleaching powder.
3. Pesticides and insecticides should be prevented from nearby use of water lakes, ponds and pools.
4. Drainage water should not be allowed to mix with drinking water.
5. Drainage system should be maintained properly.

6. Chlorination process is to be adopted for drinking water. For 1 litre of water 30 - 40 mg of chlorine is to be added to get perfect disinfection. It kills bacteria, fungi, fungal spores and other microbes also.

Noise Pollution

Everyone knows that sound is a form of energy that is capable of causing disturbances in human beings. Ears are the hearing organs in human beings. A thin membrane is called Tympanum (or) ear drum receives the vibrations produced by sound to a limited extent. Human ear is capable of perceiving about 85 decibels of sound. Beyond the limit, the ear drum cannot bear sound.

In nature, we hear different types of sounds. Sound is a kind of vibration which travel through air, water, and are sensed by the ear. This is from music, speech, etc from radio / television / computers etc., one thing in this matter is that we can increase the volume of sound or decrease as per our taste whereas,

a noise is a sound which cannot be heard clearly and only mixed sounds will be heard. For eg: in an office one is talking on mobile, phone ringing another side, ring tones in some person's hands, loud conversations with one and another etc., this is called noise. One cannot increase or decrease the volume of noise.

In general, a sound is a vibration from a particular machine, place or material which can be heard clearly whereas a noise a mixed vibrations that will come to us from all directions. A sound can be clear and can be able to hear, whereas a noise will not be clear and cannot be heard.

Sources of Noise

Noise is an unwanted sound and noise pollution occurs through different sources:

□□Vehicles produce noise that leads to noise pollution.

□□automobile industry is another source of noise pollution.

□□Noise pollution is very common in industrial areas where machines are working for factories making more noise.

The sources of noise are more in urban and industrial areas, than in rural areas. The sources of noise may be stationary or mobile. The stationary sources include industries, loud speakers, mining operations, use of machineries, TV, Radio, Grinders etc. The mobile sources include Road Traffic, Highway Noise, Railway Traffic, Air Traffic.

(1) Stationary sources:

Industrial noise: The main categories of industrial activity that are particularly relevant to the study of noise are the following:

Product fabrication

Product assembly

Power generation by means of generators.

Combusting process in furnaces. (burning of gases)

Noise from construction works: Construction noise, a major source of noise pollution is emitted by construction equipment. The sources of noise are dozers, excavators, front end loaders, soil compactors, cranes, air compressors, concrete vibrators, Riveting steel structure during the casting, dismantling of construction materials etc...

Noise from other sources: These include sources such as sirens, barking dogs, ambulances, Police vehicles, Fire engines etc..,

(2) Mobile sources:

Road traffic: Of all sources of noise pollution, road traffic is the most prevalent and perhaps the most source of noise pollution. More people are exposed to noise

from motor vehicles and the noise depends on various factors such as *Road location, Road design, Vehicle standards, Driver behaviors, Horns, Traffic density.* ,

Noise of common road vehicles

Vehicle type Noise(db)

Medium road traffic (Main roads) 70- 80
Heavy road traffic (High ways) 80- 90
Buses & Trucks upto 3.5 tons 85- 95
Trucks upto 3.5-12 tons 90-100
Motor cycles 90-105

It can be observed that motor cycles with their exposed engines and inadequate silencing arrangements are notorious noise producers, which produce more than 30 times sound than a small passenger car.

Railway traffic: Noise from railway traffic is not serious nuisance as compared to the road traffic noise. The level of noise associated with rail traffic is related to the type of engine, the speed of the train, track type and condition. The majority of noise emitted by trains is produced by the engine (or) by the interaction of wheels with the tracks, horns, warning signals at crossings etc..,

Air traffic: The noise of air craft is different from that of road traffic in the sense it is intermittent. Noise is maximum during take off and landing. Noise made by jet planes is more disturbance than that of propeller driven air craft. Supersonic air craft produce noise at high levels due to its intensity.

Effects of Noise: At 120 decibels the ear registers pain but hearing damage begins about 85 decibels. Apart from hearing loss, noise can cause lack of sleep, irritation, indigestion, ulcers, High B.P., Heart diseases , Stress etc.,.

Annoyance (Feeling slightly angry): One of the most important effects of noise on human is annoyance. Due to this breathing rate affects.

Noise- induced hearing loss: Exposure to noise for a long enough duration results in damage to the inner ear and thus decreases one's ability to hear. The louder the noise the less time it takes to cause hearing loss.

Effects on sleep: Noise disturbs sleep. It has been found that the cases related to various levels of noise are associated with sleep disturbances. Sleep disturbance by noise depends on the characteristics of the noise such as frequency, loudness and whether the noise is continuous or intermittent.

Other effects: There are many other effects of noises such involve aggression (ready to attack). People may turn mad and nerves may not function normally, People may be deformed in many ways including increased stress and strain, nonfunctioning of hands, legs etc due to noise pollution if exposed continuously.

Noise pollution control: Noise pollution could be controlled by either reducing the noise at the source or by preventing its transmission .

The first step in the prevention of noise pollution is to control the noise at source itself. for eg: Lubrication of machines reduce the noise produced, Tightening the loose nuts, Reducing the vibrations produced by machines etc…

Failing to control the noise at its source, the second step is to prevent its transmission for eg: keeping the noise machine covered in an enclosure so that the sound does not escape and reach the receivers, construction of noise barriers on road sides, sound proof the buildings by using heavy curtains on the windows, acoustical tiles on the ceiling and walls, by sealing the cracks in the walls to reduce the noise coming from outside.

If the noise levels are not able to bring down to the desired levels in some cases,

the only alternative is to follow :
□□Avoiding horns except in emergency situations.
□□Sound proof or eco-generators and Turning down the volume of stereos.
□□Conducting the awareness programs .

Marine Pollution

Pollution of oceans is damaging the marine environment and is becoming a major problem. Marine environment is interesting for various reasons such as Sea food; Navigation; Adventure; Tourism etc,, Marine Pollution is harmful and its danger can be identified in a variety of ways.

Sources & causes of marine pollution: Marine pollution originates from one of two sources --- the land or the sea which are explained below:

Marine Oil Pollution: Oil is basically an important pollutant which destroys marine environment. The various sources of oil pollution are:

Run-off oil from streets; disposal of lubricants from machines; Off shore oil and gas exploitation from off-shore drilling; blowouts at off-shore drilling rigs; oil escaping under high pressure from a bore hole in the ocean floor. ;

Waste chemicals, mud and accumulation of toxic substances in the ocean in the form of mercury, dioxin, PCBs, PAHs (Poly Aromatic Hydrocarbons) , Radioactivity. benzene; xylene (colorless, flammable liquids) and heavy metals such as lead; copper; nickel, mercury also cause for marine pollution during the off shore drilling activities. Both dumping and exploitation of ocean resources cause ocean pollution also.

PAHs: It is a chemical compound and organic pollutant. These occur in oil , coal and tar deposits and are produced as by products of fuel burning. PAHs are lipophilic meaning they mix more easily in oil than water. Eg for PAHs are: Acenaphthene; Anthracene; Benzopyrene; Chrysene; Coronene; Fluorene; Pyrene.

Other sources from land : The major sources of marine pollution originating from the land vary from country to country. Effluents are discharged either directly into the sea or enters the coastal waters through rivers.

Thousands of barrels of oil burn when oil wells were set on fire. Tanker accidents on land carries oil to the nearby streams / canals and cause for marine pollution. Due to burning of oil, smoke, SO_2, NO_2, CO are added towards atmospheric contamination.

The effects of oil pollution depend mainly on the following factors:
Type of oil and its viscosity;
amount / quantity released;
distance covered;
time;
average water temp etc..

Effects of Marine Pollution:

S No Source Effect
1 Sewage & run- off fromforestry;Depletes oxygen in water causeskilling of fishes.
2 Sediments from mining Sediments clog in the gills of fishes
3 Sewage from municipalities,
towns; cities etc…Contaminate sea food
4 Industrial discharge; pesticidesfrom farmCause disease in coastal marine life
5 Oil from off shore drilling;industries / automobiles
Low level contamination kill larvaewhereas high level contaminationcauses death for sea fishes

6 Litter (rubbish), waste, plasticsetcMarine life disturbs
7 Hot water from power plants Kills corals.

Marine Pollution Abatement / Prevention & control measures of Marine pollution:
The following are the some of the control measures for marine pollution:

- Improving existing sewage disposal facilities
- Ensuring individual houses have sewage disposal systems (such as septic tanks).
- Large resorts should use and manage their own packaged treatment plants.
- Marine planning and management should be considered as processes such as land – sea interaction; inter disciplinary co-operation; participation of public & private sector organisations; balance between protection and development public participation
- Oil tankers are double hulled (two layered bottom) to reduce the chance of oil leakage
- Recycling facilities for used oil.

Thermal Pollution

Thermal pollution is also known as heat pollution and occurs when heat is released into water or air that produces undesirable effects. Sudden heat release usually due to forest fire or volcanoes or human induced activities. Thermal pollution is also the addition of excess undesirable heat to water that makes it harmful to human, animal or aquatic life.

Sources of Thermal Pollution: Various sources of thermal pollution include Thermal Power Plants ; Nuclear Power Plants ; Petroleum Refineries; Steel Plants; Metallurgical industries; Paper Mills; Chemical Plants.

Coal fired power plants constitute major sources of thermal pollution. Nuclear plants discharge much heat and also traces of toxic radio active substances . Many industries use water for cooling purpose and thus the heat effluents are finally discharged into water.

Temperature and its effects: Temperature plays an important role in determining the conditions in which living things can survive. Birds and mammals require a narrow range of body temp for survival whereas aquatic species can exist at a certain range of temperatures.

Thermal pollution increases water temperature causing a change (lowering) of dissolved oxygen levels. This disrupts and causes decay of plant and animal species. For eg: the warmer water increases the metabolic rate of fish and other animals in the sea; this decreases the life expectancy of aquatic animals.

Management of Thermal Pollution: Thermal Pollution is controlled by the following methods:

1. Cooling Towers are designed to control the temperature of water which transfer some of the heat from the water to the surrounding atmosphere by evaporation. There are two types of cooling towers namely wet cooling towers and dry cooling towers.
2. Cooling ponds are employed for thermal discharges. Heated effluents on the surface of water in cooling ponds maximize dissipation of heat to the atmosphere.
3. Artificial lakes are man made bodies of water which offer possible alternative. The heating effluents are discharged into lake at one end and the water for cooling purpose may be withdrawn from the other end.

SOLID WASTE MANAGEMENT

Solid Waste is defined as " ***any garbage, refused materials, sludge from a waste treatment plant and other discarded material including solids, semisolids etc resulting from industrial, commercial, mining, agricultural operations etc."***

Solid Waste Management has become very important role in order to minimize the adverse effects of solid wastes. Solid waste (other than liquid or gaseous) can be classified as Municipal Solid Waste (MSW); Industrial Solid Waste; Hazardous Solid Waste; Agriculture Solid Waste; Mining Waste, Sewage Sludge Waste etc..

Solid wastes are being produced since the beginning of civilization. The disposal of Solid Waste has been increased due to the rapid developments in industrialization and urbanization. High population density, intensive land use for residential, commercial and industrial activities led to generation of more solid waste.

In Andhra Pradesh, the solid waste generated in medium and small municipalities in the range of 30 – 150 MT / day. The per capita generation of Municipal solid waste in class I cities is in between 100 – 500 gms / day per person.

Sources of Solid Wastes:

1. *Municipal Solid Waste* is commonly known as garbage consists of packing materials, furniture, clothing, bottles, food scraps, newspapers, home appliances; paints, batteries etc. Municipal solid wastes are arise from residential quarters, commercial (markets, hotels, garages); institutions; public places, open areas/streets, parks, play grounds etc. MSW also include the following wastes:

Food Wastes usually generate from domestic houses, hotels, markets and consist of fruits, vegetable residues resulting from the handling, preparation, cooking and eating of foods.

Rubbish waste consists of combustible wastes (papers; cardboards, torn clothes, plastics, wood etc) and non – combustible waste (glass, crockery, aluminum tins, ferrous metals; construction wastes).

Demolition & Construction wastes result from the construction, remodeling and repairing of residential, commercial buildings and industrial factories. These wastes include dust, stones, concrete, bricks, steel pieces etc..

Special Wastes include street sweepings, road side litter, drainage debris; dead animals and abandoned vehicle parts.

2. *Industrial Waste* arise from industrial activities such as chemical industries ; metal and mineral processing industries. Radio Active wastes are generated by Nuclear Power Plants. Thermal Power Plants produce fly ash in large quantities. Fly ash is a fine solid particles result from the burning of wood, coal and other combustible wastes.

3. *Hazardous Solid Waste* is any solid waste or combination of wastes that posses a substantial danger, now or in future to human beings and plant / animal life and cannot be handled or disposed. The following is a list of types of hazardous wastes:

□□wastes from specific and non-specific sources. For eg: disposable synergies from hospitals is a specific source identified as hazardous solid waste.

□□Ignitable materials (easily inflammable below 60oC)

□□Corrosive materials (iron rods / pieces)

□□Reactive materials (undergoes rapid reaction with water or other

substances and releases toxic gases eg: limestone / marble).
□□Toxic materials which consists of Pb, Cl (Toxic to human beings)

Effects of Solid Waste: The improper handling and transfer of the solid wastes results in various health and environmental problems. The main impacts of waste accumulation are:

□□Garbage dumping places are breeding places for diseases.
□□Rats and pigs roam and feed on garbage and transmit diseases like brain fever from pigs to human beings and plague from Rats.
□□Solid wastes may choke the drains and gully pits resulting in water logging which in turn results in breeding of mosquitoes and then cause for Malaria & dengue in human beings.
□□Noxious fumes (harmful gas) may pollute air due to the burning of waste products especially plastic containers.
□□Obnoxious (very unpleasant) odours pollute the air due to decomposition of organic solid wastes.
□□Municipal solid wastes heap up on roads due to improper disposal system. Every year several tones of solid waste is dumped along the high-ways thereby spoiling the landscape (appearance of an area of land) .
□□Urban and industrial solid wastes often contain a variety of toxic chemicals which may enter into the food chain and affect both terrestrial and aquatic organisms.

SOLID WASTE MANAGEMENT : For Solid Waste Management, we stress in *Three R's –Reduce; Reuse & Recycle* to reduce the adverse affects.

Reduce in use of Raw Material:

Reducing the use of raw materials decrease the production of waste.
For eg: Melting of broken plastic items and toys can be used for moulding them into new ones whereas plastic scrap which are not remoundable can be incinerated to get heat.
For eg: Agriculture waste of rice husk and ground nut shells can be converted into non-polluting fuel. Fermentation of agricultural wastes produce ethanol which can be used as liquid fuel. These helps in reduction of raw material for manufacturing a few things and reduction in the usage of coal, wood etc..

Reuse of solid waste Material:

Making rubber rings from the discarded cycle tubes which are used by newspaper vendors reduces the waste generation during manufacturing of rubber bands.
Waste food and vegetable peelings can be reused as food for cattle.
Producing biogas is possible from organic matter; human and animal excreta.
Waste paper can be utilized for making paper covers. Wastes of silk industry containing large quantities of waste pupae can be used as poultry feed.

Recycling of materials:

Recycling is the reprocessing of discarded materials into new useful products. Old aluminum cans and glass bottles are melted and recast into new cans and bottles. Worn-out tyres can be rebuttoned. Recycling of paper will reduce cutting of trees.
The process of reducing ; reusing and recycling saves money; energy; raw materials and reduces pollution. .

DISASTER MANAGEMENT

Disaster means a terrible event that causes a great damage / loss to the human beings . It is a situation arising from natural forces where large scale

disruption of infrastructure, services etc.. occurs. It causes a serious impact on human life, economy and environment. Natural disasters are always severe and sudden. Some disasters are:
(A) geological in nature like the earthquakes;
(B) Landslides (rocks slides down from the side of a hill); Volcanic eruptions etc..
(C) Climatic disasters / Natural calamities: These are of different types affect nations all over the world. Because of the large geographical size of the country, India often faces natural calamities like floods, cyclones and drought occurring frequently in different parts of the country. Natural calamities are of two types:
1. Major calamities: eg: earthquakes; droughts; floods, tsunamis; cyclones etc
2. Minor calamities: eg: hailstorms; avalanches; fire accidents
(D) man induced disasters include wars, battles, riots, rail/road accidents, nuclear explosions etc..
The disaster Management: The natural disaster management involves the following steps:
Relief measures: it include rescue tools; communication equipments; heavy machines to remove debris; water pumps; technicians; drugs, doctors, ambulances..
Disaster predictions: The predictions of natural hazards may be made on the basis of past history of the area with regular monitoring of the environmental changes caused by human activities to assess the genesis of natural disasters.
Education: Disaster education plays a significant role in disaster eduction. It create awareness and improve the standards to prevent from the disasters.
Geographic Information Systems: (GIS): GIS is a system that captures, stores, analyzes , manages and presents data with reference to geographic location of the area. In simple terms, GIS is the merging of cartography, statistical analysis and database technology. GIS may be used in Archaeology, Geography, Remote Sensing, Land surveying; Natural Resource Management; Urban Planning etc..
GIS programmes help by means of maps available data of the problem areas, to predict the severity of the disaster.
Words Meanings
Aerosol Atmosphere or gas containing finely divided solids or liquid particles of microscopic size (0.1 – 100 microns)
Avalanche Large amount of snow falls down.
battles Between the persons / enemies
Contamination A substance causing pollution is too low to cause harm
Dioxin Poisonous chemical
disaster Something that causes a lot of harm (bad situation)
Fly ash Fine solid particles exist during the burning of coal
Fog high concentration of liquid particles formed by the condensation of vapour (reduction of visibility to < 1 km)
Formaldehyde A chemical substance
Fumes Very fine liquid or solid particles. (0.03 - 0.3 microns)
Garbage Unwanted things
Gases Matter having no independent shape and expands continuously
Gasoline A mixture of volatile hydrocarbons used as a fuel known as petrol.
hailstorm Small pieces of frozen rain falls from the sky.

Hazard Something that is dangerous.
Haze When the air is not clear because of the presence of heat/ smoke
Herbicides: a chemical used to kill the unwanted plants
Impair To harm something and make it less good
Intangible Can't prove the feelings or quality exits
Landscape The appearance of an area of land
Litter Pieces of paper left in Public places.
Matter Physical substance that exist in the universe.
Mists Liquid particles formed by the condensation of vapor or a chemical reaction.
Noxious gases Harmful gases
Obnoxious Very unpleasant
Pollutant The substance or energy or things which cause pollution.
Eg: aerosol, dust, smoke, fly ash, gases, fumes, smog, fog..
Radon A type of gas due to poor ventilation. It is confined to inside the house.
Riots Violent behavior by a crowd of people.
riots Between the communities ie., violent behavior by a crowd of people
Sludge Soft, wet soil
Smog Mixture of smoke & fog or contain large quantities of different chemicals
Smoke Results from incomplete combustion of fuels(0.001- 1 microns)
Soot Results from incomplete combustion of carbonaceous material viz bituminous coal, kerosene lamp. eg chimney consists soot.
SPM A mixture of liquid or solid particles and gas under pressure which is released from a container.eg deodorants
War Between the nations

UNIT - V: GLOBAL ENVIRONMENTAL PROBLEMS & GOBAL EFFORTS

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The problems caused by pollutants such as NOx, Sox etc are now worldwide issues. Heating of earth surface; poor air quality in urban areas; the formation of acid rains, depletion of ozone layer; emission of gases are of our environmental issues which are to be studied.

GREEN HOUSE GASES (GHG) & GREEN HOUSE EFFECT: Greenhouse

gases are those that can absorb and emit infrared radiation. In order, the most abundant greenhouse gases in Earth's atmosphere are: water vapor; carbon dioxide; methane ; nitrous oxide; ozone. In addition to the main greenhouse gases listed above, other greenhouse gases include sulfur hexafluoride, hydrofluorocarbons, CFC's etc..

Chloro Fluoro Carbons are non – toxic; non-flammable contain fluorine, carbon and chlorine atoms. The five main CFCs are the :

CFC- 11 (Trichloro Fluoro Methane … $CFCl_3$)

CFC- 12 (Dichloro Fluoro Methane … CF_2Cl_2)

CFC- 113 (Trichloro Tri Fluoro Ethane … $C_2F_3Cl_3$)

CFC- 114 (Dichloro Tetra Fluoro ethane $C_2F_4Cl_2$)

CFC-11 5 (Chloro Penta Fluoro ethane C_2F_5Cl)

The major uses of CFCs are:

□□as coolants in refrigerators (CFC 11, 12, 113,114,115);

□□in air-conditioners and in fire extinguishers (Halogen + HCFC 123) ;

□□as solvent in cleaning particularly electronic circuit boards (Methyl chloroform and Carbon Tetrachloride).

□□CFC's are used as sterilization agent in medical field (mixture of CFC12 & ethylene oxide) and propellant in aerosols like deodorants; shaving foam, perfumes etc .

Man made CFC's however, are the main cause of stratospheric ozone depletion. CFCs have a lifetime in the atmosphere of about 20 to 100 years and as a result one free chlorine atom from CFC molecule can do a lot of damage.

Methane (CH_4): The major source of methane is extraction from geological deposits known as Natural gas and used as fuel. Since it is a gas at normal conditions, methane is distributed through pipe lines. It is also called as LNG (Liquified Natural Gas). Methane reacts with halogens and produce Methyl Chloride (CH_3Cl), Chloroform ($CHCl_3$) and Carbon tetrachloride (CCl_4).

Since the beginning of the Industrial Revolution, the burning of fossil fuels has contributed to the increase in carbon dioxide in the atmosphere from 280 ppm to 390 ppm. When these gases are ranked by their direct contribution to the greenhouse effect, the most important are:

Gas Formula Contribution (%)

Water vapor H_2O 36 – 72 %

Carbon dioxide CO_2 9 – 26 %

Methane CH_4 4 – 9 %

Nitrous oxides NO_x 3 – 7 %

Ozone O_3 3 – 7 %

Of these gases, CO_2 accounts for about 55% of the earth's Green House effect. Other gases are capable of changing the energy balance and causes for increase of temperature of the earth. A number of changes usually take place in the energy which comes from the sun through the atmosphere.

In detail:

26% of the energy is reflected back to the space by clouds and particles whereas about 19% of the energy is absorbed by some of the gases especially ozone in the atmosphere. 4% is reflected from the surface back to space.

Of the remaining 51% of the solar energy is then used in a number of process including the heating of the ground surface, evaporation of water

etc….
The main sources of greenhouse gases due to human activity are:
□□Burning of fossil fuels and deforestation leading to higher carbon dioxide concentrations in the air.
□□Use of chlorofluorocarbons (CFCs) in refrigeration systems, and use of CFCs and halogens in fire suppression systems and manufacturing processes. Some halogens are used in fire extinguishers; they in turn produce CFC's. Hence, CFC emissions increases in the atmosphere and then causing Green House Effect .
□□Agricultural activities, including the use of fertilizers, that lead to higher nitrous oxide (N2O) concentrations.
Hence, **Green House effect** is a naturally occurring process that aids the heating of the earth's surface and atmosphere. Green House effect results from the gases such as CO2; CH4 (methane); N2O (Nitrous Oxide); CFC's; Halogens (F, Br, Cl, I) & O3. Ultimately, the Green House effect may lead to the death of both plants and animals including human beings.
GLOBAL WARMING: Earth has become warmer over the last centaury. As a result of higher concentrations of gases (especially CO2) ; the earth's climate become warmer and this is referred to as Global Warming. Reports that the average climate / temperature of the earth has increased during the twentieth century by about 0.6oC (+/- 0.2oC).
The IPCC (Inter-government Panel on Climate Change), a group established by the World Meteorological Organization (W M O) and The United Nations Environment Programme (UNEP) revealed the following effects of global warming:
□□Global warming causes, rate of precipitation decreases on land and causes a decrease of rainfall by 40% all over the world.
□□Sea level raises and low lying areas will be inundated (to cover an area of land with water)
□□Global Warming change the direction of wind.
□□CFC's convert O3 into oxygen and oxygen radical and thus ozone depletes in the atmosphere.
□□Global temperature will increase atleast by 4oC.
□□Decrease of earth's albedo (the amount of sun light reflection by the earth's surface to the moon) .
□□People suffer from many undiagnosible diseases.
□□CFC-11; 12 and 113 in the atmosphere for a longer period harmful to the human beings.
SOLUTIONS FOR GLOBAL WARMING:
□□By reducing the emissions of Green House gases.
□□Clean electricity technologies such as wind mills/turbines; solar panels; tidal energy etc are to be used
□□Bio-fuels (eg: ethanol - a type of alcohol) and Bio-diesel could substantially cut down the CO2 emission.
□□By avoiding the driving of vehicles (walking / bicycling is to be followed)
CLIMATE CHANGE & their impacts on Human Environment

The weather conditions and seasonal variations in a region over a long period is called CLIMATE. The average temperature in many regions has been increasing in recent decades. Globally, 1990 was the warmest decade on record.

Climatologists of the Inter-governmental Panel on Climate changes (IPCC) have carried out several experiments in order to estimate the changes in climate.

Accordingly, First Assessment Report (FAR) was completed in 1990 and Second Assessment Report (SAR) in 1997. Following are the main points from the climate reports:

The concentration of Green House Gases in the atmosphere such as CO_2; Methane; Nitrous Oxide have all increased markedly since 1750 and now exceeded the levels.

Emissions of Carbon dioxide from fossil fuel has been increased from 1990's onwards.

The Third Assessment Report (TAR) on climate change 2001 is the most comprehensive and up-to-date scientific assessment of past, present and future climate change. The report:

Analyses an enormous body of observations of all parts of the climate system.

Increasing concentrations of atmospheric greenhouse gases.

Assesses our understanding of the processes and feedbacks which govern the climate system.

Projects related to scenarios of future climate change using a wide range of models of future emissions of greenhouse gases and aerosols.

Fourth Assessment Report was released in 2007 and concluded that 90% of human beings are caused for Global Warming.

The concentration of the Carbon Dioxide in the atmosphere (379 ppm in 2005) is higher than the past years (180 to 300 ppm) mainly due to fossil fuel usage.

The studies have also shown that in the near future the Global surface temperature will rise by 1.4oC to 5.8oC and leads to floods and/or droughts.

The Global mean seal level is projected to rise by 9.88 cm by the year 2100.

The studies / reports also stated that a few regions such as NILE DELTA in Egypt and Ganges – Brahmaputra delta in Bangladesh may become vulnerable (liable to be damaged).

Finally, it was concluded that continued Green House Gas emissions cause further Global warming and induce many changes in the Global climate system during the 21st centaury.

IMPACTS ON HUMAN BEINGS

Human environment will be seriously affected by extremes of climate by means of Floods and Droughts.

Due to extreme changes in Climate, Human beings suffer from safe drinking water.

Changes in climate may affect the distribution of vector species (eg mosquitoes) which in turn spread infectious diseases such as Malaria; Filariasis, Dengue, diarrhea; Yellow fever etc..
The reduction in food production would lead to starvation.
Climate change could lead to migration of humans.

El Nino – LA NINA

Oceans not only control the climate of the areas by absorbing and storing solar energy, but also distribute heat between lower and higher latitudes. The **Pacific Ocean** is the largest of the Earth's oceanic division extends from the Arctic in the north to the South of Antarctica, bounded by Asia and Australia in the west, and the US (Americas) in the east. The equator subdivides it into the **North Pacific Ocean** and **South Pacific Ocean.** Interesting examples of the interaction between the oceans and the atmosphere are the **El Niño and La Niña phenomena** patterns.

El Nino is defined by prolonged differences in pacific ocean surface temperatures. It is also defined as a periodic warming ie variations in the temperature in the Pacific ocean. The accepted definition is a warming of at least 0.5 °C (0.9 °F) over the east-central Pacific Ocean. Typically, this anomaly happens at irregular intervals of 3–7 years..

Because of variations in the temperature, the winds create cyclones, which is an another sign of a El Niño. The Pacific Ocean is a heat reservoir (that drives global wind patterns) and the resulting change in its temperature alters weather on a global scale.

Global wind patterns means “the region of Earth receiving the Sun's direct rays is the equator. Here, air is heated and rises, leaving low pressure areas behind. Moving to about thirty degrees north and south of the equator, the warm air from the equator begins to cool and sink. The air movements toward the equator are called **trade winds”.**

The European Remote Sensing Satellites ERS-1 and ERS-2 measured sea surface topography continuously since July 1991. One of the areas of interest is the Pacific Ocean where the famous El Niño roars every year. This event is characterized by relatively high sea level (along the coast of Central America) accompanied by with heavy rainfall. At the same time, sea level drops in the Western Pacific ocean , where extreme droughts devastate crop yields.

Envisat was launched in 2002 is the largest Earth Observation spacecraft . It carries ten sophisticated optical and radar instruments to provide continuous observation and monitoring of the Earth's land, atmosphere, oceans and ice caps. More advanced imaging radar, radar altimeter and temperature-measuring radiometer instruments extended ERS data . This is supplemented by new instruments including a medium-resolution spectrometer sensitive to both land features and ocean colour. Envisat also carries two atmospheric sensors monitoring trace gases.

The first signs of an El Nino are:

Rise in surface pressure over the Indian Ocean, Indonesia and Australia

Fall in air pressure in eastern Pacific Ocean

Warm air near Peru, causing rain in the northern Peruvian deserts.

The white areas off the tropical coasts of South and

North America indicate the pool of warm water
ENVISAT
LA NINA: The results of La Niña are mostly the opposite of those of El Niño. La Niña often causes drought conditions in the western Pacific but flooding in northern South America; mild wet summers in northern North America, and drought in the southeastern United States.
During a period of La Niña, the sea surface temperature across the equatorial Eastern Central Pacific Ocean will be lower than normal by 3–5 °C.
Eg: Singapore experienced the driest February in 2010 with 6.3 mm of rain fell in the month and temperatures hitting as high as 35 degrees Celsius.
The name La Niña originates from Spanish, meaning "the girl," analogous to El Niño meaning "the boy."

OZONE LAYER and Ozone layer depletion

The earth's atmosphere is composed of several layers viz.,
EXOSPHERE ……. The outer most layer extended upto 960 ms….
THERMOSPHERE… Layer extended upto 400 km from Mesosphere
MESOSPHERE .... another layer extended upto 80km from the surface of the earth
STROTOSPHERE .. next layer extended upto 50 km from the surface of the earth
TROPOSPHERE … lower layer extended upto 18 km from the surface of the earth
OZONE FORMATION: Ozone is a form of oxygen that has three atoms in each molecule (O3). Ozone is bluish colored and highly poisons gas that has a boiling point of 112oC. At atmospheric pressure, ozone can partially dissolve in water. At standard temperature and pressure, the solubility of ozone is thirteen times that of oxygen.
Standard Temperature and Pressure**:** STP is commonly used to define standard conditions for temperature and pressure which is important for the measurements and documentation of chemical and physical processes. *STP is defined by IUPAC (International Union of Pure and Applied Chemistry) as air at 0oC (273.15 K, 32 oF) and 105 pascals or 100 kPa .*
The atmospheric ozone density is measured in Dobson Unit (DU). 1 Dobson unit under standard temperature and pressure is 2.69 x 1016 ozone molecules per sq cm. The instrument to measure total ozone from the ground is called the Dobson ozone Spectrophotometer.
Ozone is formed by the action of sunlight on oxygen. When normal oxygen absorbs solar ultra violet radiation; splitting oxygen molecules into radical oxygen (O). This atomic oxygen quickly combines with further oxygen molecules to form ozone . This action takes place naturally in the atmosphere.
O2 + UV O + O
O + O2 O3
DESTROY OF OZONE LAYER : *Two different processes destroy ozone naturally:* The first is when a free oxygen radical combines with an ozone molecule to produce two diatomic oxygen molecules.

$O + O_3 \; 2O_2$

The other process when ozone molecules absorb ultraviolet radiation and form one diatomic oxygen molecule and one free oxygen radical .

$O_3 + UV \; O + O_2$

OZONE DEPLETING SUBSTANCES (ODS)

Ozone Depleting Substances (ODS) are those which deplete the ozone layer.

The ODS's are Chloro Fluoro Carbons …… CFS's

Hydro Chloro Fluoro Carbons …….. HCFS's

Methyl Chloroform

Carbon Tetrachloride and Halogens

EFFECTS on human beings:

- Ozone makes human beings eyes itch, burning sensation.
- It lowers the human body resistance power and leads to cold and pneumonia.
- Ozone reacts with tissues and cause for breathing and decrease the working ability of the lungs and
- The thinning of the ozone layer may lead to an increase of skin cancers .

EFFECTS on Global environment :

Certain crops may be damaged if ozone layer is depleted thus affecting natural food chains and food webs so that the ecology system disturbs. The effect of ozone depletion in Antarctica is severe; however, the ozone in the arctic region should not be neglected.

Depletion of ozone causes Global warming.

INTERNATIONAL CONVENTIONS / PROTOCOLS

Convention: large formal meeting of people with the same interest or work.

Protocol: The rules about what you must do and how you behave in an official situation.

The objectives of the International Conventions are to stabilize the Green House Gas concentrations in the atmosphere to certain levels to prevent dangerous human interference with the climate system of the world..

EARTH SUMMIT: The **United Nations Conference on Environment and Development** (UNCED), also known as the **Rio Summit**, **Rio Conference**, **Earth Summit** (Portuguese) was a major conference held in Rio de Janeiro from 3 June to 14 June 1992. Totally 172 Governments were participated with their heads and representatives, NGO's accounting 17000 people. The issues included:

- Systematic scrutiny of patterns of production of Toxic components such as lead in gasoline.
- Alternative sources of energy to replace the use of fossil fuels which are linked to global climatic changes.
- By introducing new public transport system in order to reduce vehicle emissions in cities.
- Alarming the growing scarcity of water and has been decided to come out with proper utilization methodologies.
- Not to carryout any activities on lands that would cause environment degradation.

MONTREAL PROTOCOL:
Several meetings have taken place to address the ozone layer depletion problem. The well known meeting was held in Montreal on 16-09-1987 and the agreement signed is called the Montreal Protocol, which set a timetable to phase out of CFCs as well as halogens which contain bromine and 96 harmful chemicals in the Protocol subject the schedules.
The **Montreal Protocol** on substances that deplete the Ozone Layer is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion. The treaty was opened for signature on September 16, 1987, and entered into force on January 1, 1989, followed by a first meeting in Helsinki (Finland), May 1989. Since then, it has undergone seven revisions, in 1990 (London), 1991 (Nairobi capital of Kenya), 1992 (Copenhagen, capital of Denmark), 1993 (Bangkok in Thailand, SE Asia), 1995 (Vienna, capital of Austria), 1997 (Montreal, Canada), and 1999 (Beijing, china).
After implementing the schedules, following are the identified advantages of Montreal protocol:
The highest calculated level of consumption of CFCs was 16,255 metric tons in 1988. Substances were used chiefly as refrigerants, cleaning solvent, foam blowing agents and propellants in spray can. In 1996 the consumption level was reduced to zero and maintain at that level since.
HCFCs have been used as one of the alternative substances for CFCs since 1996. As a result, consumption of HCFCs was reduced from around 630 ODP (Ozone Depletion Potential) metric tons in 1996 to 383 ODP metric tons in 2004, which indicated a 40% reduction from the baseline level.
Without the protocol there would be a doubling effect of Ultra violet – Beta radiations reached the earth in the northern latitudes and also the amount of ozone depleting chemicals in the atmosphere would have been 5 times greater.
It also ensured the improved scientific understanding which can be incorporated in decisions quickly.
It is believed that if the International agreement is adhered (sticking to) the ozone layer is expected to recover by 2050.
KYOTO PROTOCOL :
The Kyoto Protocol is a legally binding International agreement to reduce Green House Gas (GHG) emissions of 5.2% by the year 2012.
The Protocol states that “developed countries are committed, individually or jointly to ensure that the emissions of Green House Gases do not exceed amounts assigned to each country in Annexure A to the Protocol.
The agreement specifies that all countries must follow a number of statements and some of which are as follows:
Design and implementation of climatic change mitigation (to reduce the harmful effects of something) and adoption programmes.
Preparation of a national inventory of emission removal procedures.
Promotion of climate friendly technology transfer.
Accounting, reporting and review to ensure the integrity (honesty and

the ability to do) of the protocol.

DEFORESTATION AND DESERTIFICATION

Forests are one of the most important natural resources and a part of biosphere since these are natural assets on this earth. Forests predominantly composed of trees, shrubs, woody vegetation etc… Approximately 1/3rd of the earth's total land area is covered by forests.

Forests are important ecologically and economically. Ecologically forests are to be considered as earth's lungs because they consume CO2 and release O2 which is required for sustaining the life on this earth. The poisonous gas CO2 is absorbed by the trees of forests and reduce the global warming; helps to continue hydrological cycle, reduce soil erosion….

Forest ecosystems are extremely good & hold a good quantity of water.

Economically forests provide timber, fodder to grazing animals, firewood (conventional fuel), bamboos, rubbers, medicines, gums, resins, food items etc.

Deforestation refers to the loss of forest cover (or) the aimless destruction of trees . The clearing of forests across the earth has been occurring on a large scale basis for many centuries. This process involves the cutting down, burning and damaging of forests.

Currently 12 million hectares of forests are cleared annually and the current rate of deforestation continues, the world's forests will vanish within the next 100 years About 80% of the original forests on the earth has already been cleared.

Deforestation is taking place in many parts of the world for many reasons such as:

- for need of money for developing / weak countries (Malaysia cleared 3.5 million hectares of forest for rubber and oil palm plantations)
- to construct various projects;
- To pay international debts if any
- To develop industries
- For making roads to access the interiors of the areas

EFFECTS OF DEFORESTATION:

The removal of trees leads to soil exposure & results in soil erosion, rapid water run-off, loss of wildlife.

Deforestation ---- cause unknown effects on global climate and eliminating the majority of plant and animal species on this earth. Various living beings (wildlife is diminish) may come down resulting in imbalance of forest ecosystem.

- A variety of food products such as coffee, tea, spices, nuts, fruits etc will be reduced.
- Rainfall decreases to a great extent.
- Climatic conditions MAY are change.
- Historical values are lost.

CASE STUDIES:

Chipko movement related to mining or quarrying opposed by Sundarlal Bahuguna in North India (refer text books for further information)

Sardar Sarovar – Narmada project is a multipurpose project in Gujarat (refer text books for further information)

DESERTIFICATION: The processes by which an area becomes even more

barren, less capable of retaining vegetation and is known as a desert. This may become a disaster in long term. Hence, desertification refers to land degradation in arid and semi-arid areas due to anthropogenic activities. Desertification often starts as patchy destruction of productive land. Increased dust particles in atmosphere also lead to desertification .

The chief causes of desertification also include:

Climatic factors and (ii) human factors (population growth, increased population density

According to the United Nations Environmental Programme (UNEP), deforestation is an important factor contributing to desertification. At the time of Independence in India, about 22% of area was under forest cover and today this has been reduced to 19%

UNEP estimated that desertification threatened 35% of the world's land surface and 20% of the world's population.

UNIT – VI : ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENTAL MANAGEMENT PLAN

Contents:

Definitions of Impact; Impact Assessment and Environmental Impact Assessment
Classification of Impacts
Significance of effects
Methods of Baseline Data Acquisition
Prediction of Impacts & Impact Assessment Methodologies
Environmental Impact Statement
Environmental Management Plan
Green Belt Development
Water Conservation & Rainwater Harvesting methods
Geographic Information System
Remote Sensing

Definition of Impact: An impact can be defined as any change in physical, chemical, biological, cultural or socio-economic environmental system as a result of activities: relating to a project OR adverse effects caused by industrial, infrastructural projects OR by the release of a substance into the environment.

Definition of Impact Assessment: Impact assessment is the process of identifying the future consequences (bad results) of a proposed project. Impact Assessment ensure that projects, programmes and policies are economically viable; socially equitable and environmentally sustainable.

Definition of Environmental Impact Assessment: The United Nations of Environmental Programme (UNEP) defined that EIA is a tool used to identify the environmental and economic impacts of a project prior to decision making regarding the project planning, design, adverse impacts, etc..

For all proposed and development projects, whether Government or Private, the Ministry of Environment and Forests (MoEF) requires an Environmental impact assessment report related to the following parameters:

The report must define what impact it would have on water; soil and air including flora and fauna.

Affect on the lives of local people.

To ensure that no way harm the environment on a short term or long term basis.
Why is EIA important ?
By identifying potential alternatives and adverse impacts, Nations can better achieve goals for sustainable development; avoid adverse environmental; social and cultural impacts; reduces cost, provides better plan for infrastructure etc..
D**r G SUBBARAO, PROFESSOR, A V N INSTITUTE OF ENGG & TECHN, HYD**
Mob: 94944 13053
CLASSIFICATION OF IMPACTS:
Environment impacts arising from any development projects fall into three categories: (i) Direct impacts
(ii) Indirect impacts and
(iii) Cumulative impacts.
According to their nature, these three groups reveal :
- Positive and negative impacts
- Reversible and irreversible impacts
- Light, moderate and severe impacts
- Local and widespread impacts
- Short – term and long – term impacts

For eg to construct a major project: **Direct impacts are** related to:
(a) aesthetics in the area (understanding of beautiful things); (b) traffic at nearby junctions, (c) removal of natural vegetation; (d) interference with natural water ways; (e) additional housing or commercial shops to support employees.
Indirect impacts may occur due to delay in time for the proposed project whereas **Cumulative impact** occur where individual projects when combined with other projects may cause an overall adverse cumulative effect.
Ex of various types of impacts that occur in a *typical Road Development project:*
Direct impacts are caused by the removal of gravel from a pit for use of surfacing the road. In this case, the land area in which the pit site is located has been directly affected by activities associated with the road project.
Indirect impacts are difficult to measure, however, such as the land degradation, quality of surface water, urban growth near a new road.. New roads often lead to the rapid depletion of animals due to poaching (illegal catching and animals).
A cumulative impact might be the de-vegetation and the roadside vegetation is also damaged by vehicle and foot traffic and the soil is left unprotected.
The vegetation never has enough time to recover (because of high traffic volume on the road) and the problem is exacerbated (to make something worse) over time.
SIGNIFICANCE OF EFFECTS: Significant effects are likely to occur where valuable resources are subject to impacts of severity. EIA is recognized by adopting the five levels of significance as described in the draft to good practice and procedures. These five levels of significances are::
Severe: Sites of national importance and unique resources (to exist in only one place) if lost, cannot be replaced or relocated.
Major : These effects are to be important considerations at a regional or district scale during the decision making process..
Moderate: These effects at a local scale are likely to be key decision making

issues.
Minor: These effects may be raised as local issues but are unimportant in the decision making process.
Neutral: No effect, not significant.

METHODS OF BASELINE DATA ACQUISITION:

An Environmental Baseline Study (EBS) is an investigation conducted to establish the level of contaminants in the project areas and to assess the extent of contamination. The information needed to conduct an EBS can be acquired from the available sources:

Land features include topography; climatology (temperature, rainfall)
Geology & Hydrogeology (Lithology of rock formations, drainage pattern, ground water table)
Air environment (study of SPM, SOx; NOx)
Noise environment
Water Environment (pH; TDS; F; dissolved Oxygen; BOD etc..)
Soil quality Soil analysis reflect the presence of nutrients like N, P, K, Ca, Mg, Fe, Mn and Al
Flora and Fauna of the proposed area
Socio economic study include Population density; Literacy rate; Category of workers viz., cultivators, agriculture laborers, etc);
Medical facilities ; Main sources of availability of water viz., rivers, canals, hand pumps, taps etc..

PREDICTION OF IMPACTS AND IMPACT ASSESSMENT SYSTEMS (METHODOLOGIES)

One of the main challenges in today's society is to access to have a relevant and quality environmental data.

An impact assessment system must consist of:

- All aspects of consequence reports (especially a bad result report) about existing and future emissions to air.
- Projection of pre-situation, accidental situations etc of the site area should be mapped.
- Screening to determine the effect of impacts in a proposed project require a full or partial impact assessment study
- To identify the potential impacts to assess the alternative solutions that avoid adverse impacts on biodiversity

E I A METHODOLOGIES include:

1. Adhoc methods: In this method, each environmental area such as air; water and the nature of impacts (short term or long term ; reversible or irreversible) are considered.

This method serves as a preliminary assessment which helps in identifying more important areas like: **Wildlife, Endangered species; Natural vegetation; Grazing; Natural drainage; Groundwater; Air Quality; Economic values; Public facilities** etc…

2. *Checklist methodologies:* Checklists in general are strong in impact identification. Impact identification is the most fundamental function of an EIA. These are of 4 broad categories used in E I A system. They are:

(i) Simple Check lists: A list of parameters without guidelines provided

on how to interpret.

Examples for simple checklist parameters;

Land Use includes open space, Agricultural land; Residential; commercial; Industrial.

Water resources include Quality, irrigation; Groundwater

Air Quality include oxides (sulphur, C, N); SPM; Odors; Gases

Service Systems include Schools; Police; Fire Protection; Water & Power System.

Biological conditions include Wildlife; Trees, Shrubs.

Aesthetics include Scenary; Structures.

(ii) Descriptive checklists: A list of environmental parameters with guidelines provided on how to interpret.

(iii) Scaling Checklists: Similar to descriptive checklists with additional information.

(iv) Scaling Weighing Checklists: These are decision making parameters.

(3) Matrix methods: A matrix should be considered as a tool for the purposes of analysis that means the interactions between various activities and environmental parameters. For eg:

ACTIVITY ENVIRONMENTAL PARAMETERS

Resource extraction needs

Drilling & Blasting affects on Flora/ Fauna, insects; Fishes

(4) Network Matrix: Networks generally consider only adverse impacts on the environment and hence decision making in terms of the cost and benefit of a project to a region.

(5) Overlay methods: These methods involve preparation of a set of maps, which represent the spatial distribution of certain parameters. For eg: extent of forest area. Geographic Information Systems are now being used for these methods.

(6) Environmental Index: Following some of the codes are considered:

L denotes Criteria

P denotes completely satisfied

N denotes criteria not satisfied

(7) Cost / benefit analysis: It provides the nature of expenses and benefits of a project.

Essential steps to complete an environmental impact assessment include:

- Describe the proposed project as well as options
- Describe the existing environment
- Select the impact indicators to be used
- Predict the nature of environmental effects
- Assess the significance of the impact

Environmental impact statement:

Most development projects such as industries, roads, railways and dams affect the lives of local people. New projects are called “Green Field Projects” where no development has been done. Projects that already exist but require expansion are called “Brown Field Projects.” Projects can be classified into

(a) Mild Projects

(b) Moderate Projects
(c) Serious Projects
Some projects may have a temporary impact during the construction phase which could be later become less damazing. In other situations the impact may continue and even the affect of impact may increase (for eg: where toxic solid waste will be constantly generated).
Environmental Impact Statement is a
Tool for decision making.
Document prepared to describe the affect of proposed activity.
Document that describes the impacts as a result of proposal action.
Council for Environmental Quality Regulations (CEQ) provide the recommended format and environmental impact statements , generally forwarded to MoEF.
The EIS has Typically four sections
1. An introduction including a statement of the purpose and the need of the proposed action.
2. A range of alternatives to the proposed action.
3. A description of the affected environment
4. An analysis of the environmental impacts of each of the possible alternatives.
Hence an Environmental Impact Statement (EIS) which is a summary of the project is kept for the public to read,
The venue and the time of public hearing is declared.
Once the hearing is held, opinions have been expressed both for and against the project (positive and negative ideas).
The recorded minutes of meeting both positive and negative are sent to the MoEF.

Environmental Management Plan:

Environmental Management Plan (EMP) is aimed to maintain the existing environmental quality.
The main objective of EMP is to investigate specific activities which are related to adverse impacts. The impacts can be first minimized by various planning activities. Some more measures can be practiced to minimize the impacts on environment are as follows:
The debris and unutilized construction material from construction site should be removed immediately.
Vehicles employed should be checked for proper emissions.
Construction activities shall not be allowed at night times.
The mitigation measures shall include regular maintenance of machinery and provision of productive equipment to workers where needed.

Green Belt Development

A **green belt** is a policy and used in land use planning to retain areas of largely undeveloped land or agricultural land surrounding or neighbouring urban areas. Green belt development also has a special importance in hydro electric projects as the project construction process emanates lot of dust due to excavation works, crushing of material and batching of aggregates. In addition, air pollution also takes place due to vehicular movement during construction and operation phases.
In order to combat different kind of pollutions and avoid land slips from the portion of catchment area, a green belt is usually developed along project site & around the

reservoir.
The objectives of green belt policy are to:
Protect natural or semi-natural environments;
Improve air quality within urban areas;
The green belt has many benefits for people:
Walking, camping, and biking areas close to the cities and towns.
Contiguous habitat network for wild plants, animals and wildlife.
Cleaner air and water
Better land use of areas within the bordering cities.
The general consideration involved while developing the greenbelt are:
- Trees growing up to 10 m or above in height should be planted .
- Planting of trees should be undertaken in appropriate encircling rows around the project site.
- Generally fast growing plant species should be planted.
The effectiveness of Green Belts differs depending on location and country. In the 7th Centuary, Muhammed established a Green Belt around Medina by prohibiting any further removal of trees in a 12 – mile long strip around the city.
Although the forest loss due to the reservoir submergence and construction of various projects can be compensated if afforestation is implemented . However, it is proposed to develop greenbelt around the perimeter of various project boundaries , selected stretches along reservoir periphery, etc.
Recommended tree species for Greenbelt Development
Botanical name Common name
Dendrocalamus sp. semla
Callistemon citrinus Battle Brush
Calotropis gigantea Gigantic Swallow
Wort
Emblica officinalis Omla
Ficus benjamina Chilabor
Aegle marmelos Bel
Fruit and medicinal
Albizia lebbeck Siris
Cinnamomum tamala Tej pata
Spices, medicinal, fuel
BUDGET: The cost of plantation is estimated at Rs. 40,000 per ha which includes sapling cost, nursery cost, labour cost, cost of manure, weeding etc. It is proposed to afforest about 50 ha of land as a part of Greenbelt Development Plan. The total cost works out to Rs 20,00,000 . The plantation for this purpose will be carried out by Forest Department, state government of Arunachal Pradesh.
The plantation will be at a spacing of 2.5 x 2.5 m. About 1600 trees per ha will be planted. The treated wastewater and the components manure generated by solids waste will be used for the greenbelt development.
Notable green belts can be observed in the following countries:
Australia
Brazil: With approximately 17,000 km².
Canada: Ottawa Greenbelt - Surrounds the Capital city of Ottawa; Greenbelt of

Golden Horseshoe is 7300 km²
Europe: European Green Belt; Stockholm Eco park; German Green Belt
New Zealand : Dunedin's Town Belt is one of the world's oldest green belts, having been planned at the time of the city's rapid growth during 1860s.
Pakistan: Islamabad, often called the "green city," is known for its green belts found on most roadsides which are often decorated and filled with various flora.
The Philippines : Makati City's green belt is very green yet full of malls and modern structures.
South Korea: Seoul
United Kingdom: There are fourteen green belt areas, in the UK covering 16,716 km² of England, and Scotland;.
United States: The U.S. states of Portland, Oregon; Virginia ; Lexington, Barton Creek Greenbelt, Austin;

WATER CONSERVATION & RAINWATER HARVESTING METHODS

Water conservation means "*saving water for future*". Water is necessary to man for many purposes and also for metabolic activities. Due to growth of population, industrialization and expanding agriculture have pushed up the demand for water. Efforts have been made to collect water by constructing dams, reservoirs, digging wells, and by implementing water shed management methods .

Water shed management means the wet lands should not be flooded with water and water logging should be avoided. Sprinklers (or) drip methods of water supply should be used. Ground water recharging by means of harvesting rain water is also should be used. In ancient India, water conservation methods were adopted for eg:

1) Indus Valley Civilization in Western & Northern India especially at both Mohenjodaro and Harappa.

2) Dholavira a village in Rann of Kutch area in Gujarat where a large number of tanks were made in the rural to provide drinking water.

3) In Tamil Nadu, the ancient people stored rain water in places separately one for drinking purpose and another for bathing and the other for domestic purposes and called them as ***Ooranies.***

4) *In* south India, temples are built with a small tank at the centre which is called as Koneru. During the monsoon season, these koneru's get filled with water so that they are used for many purposes .

***Methods for water conservation*:**

A. *Decreasing run-off losses:* Huge water loss occurs due to run-off; which can be reduced by allowing the water to infiltrate into the soil. By adopting

(1) Contour cultivation (Cultivation across the slope without much skill to the benefit of conservation water in any region

(2) Terrace farming (Construction of a series of benches for catching the runoff water where the slope is above 15 degrees)

(3) Water spreading (Water flow is controlled by a series of diversions with vertical intervals and small depressions are dug in the area for temporary storage of water)

(4) Surface residues (Crop residues, animal residues etc help reducing run – off by allowing more time for water to penetrate into the soil).

B. Reducing evaporation losses: This is more effective in sandy soil and less effective in loamy sand soils. A chemical called "super Slurper" (starch + Acrylonitrile)

absorbs water if used in sandy soils.
C. Reducing irrigation losses: Irrigation in early morning/ late evening reduces the evaporation losses. Sprinkling and drip irrigation methods conserve water by 30%. Growing hybrid crop varieties with less water requirements help conserve water.
D. Increasing block pricing: The consumer has to pay a proportionately higher electricity bill with higher use of water. This helps in economic use of water by the consumers.
E. Preventing wastage of water: Wastage of water is to be arrested in houses, commercial buildings, public places etc.. Closing taps when not in use; repairing leakages from pipes & using small capacity flush in toilets prevent wastage of water.
*F. Rainwater harvesting Methods***:** Rainwater harvesting means collecting rain water on the roofs of buildings and storing it underground for later use.
Rainwater Harvesting Methods : Rain water harvesting means collecting rain water and storing it underground for later use. Not only this method recharging the groundwater, it also raises the water table and help augment water supply. Town and civic authorities in many cities in India are introducing by laws making rainwater harvesting compulsory in all new structures.
Rain water harvesting methods are classified as ., Traditional and Modern methods. Traditional Rainwater Harvesting is still prevalent in rural areas as surface storage bodies like lakes, ponds, tanks etc..
Modern methods of Rainwater harvesting are include Absorption pit method; absorption well method; and recharge trench method and collecting rain water on the roofs of buildings and stored in underground.
Fig depicts rain water harvesting facility for a building.
Geographic Information System
A **geographic information system** (GIS) is a computer-based tool for mapping and analyzing geographic features (phenomenon) that exist and events occur on earth. A **GIS** that captures, stores, analyzes, manages, and presents data that are linked to locations. In the simplest terms, GIS is the merging of cartography , statistical analysis, and database technology .
GIS applications allow users to analyze spatial information, edit data and maps and present the results of all these operations. A GIS has 4 main functional subsystems. These are:
1. **A data input subsystem**: It allows the user to capture, collect and transform spatial and thematic data into digital form. The data inputs are usually derived from a combination of hard copies of maps, aerial photographs, Remote Sensing images, Reports, Survey documents etc.
2. A data storage and retrieval subsystem: It organizes the data and attribute (a quality ie a particular point of thing) and permits quickly retrieved by the user for analysis and accurate updates to be made to the data base.
3. A data manipulation and analysis subsystem: It allows the user to define and execute spatial information. This subsystem is known as the “heart of a GIS” and usually distinguishes it from other database information system and computer-aided drafting systems (CAD).
4. **A data output and display subsystem:** It allows the user to generate graphic displays (normally maps) and tabular reports.

USES: GIS may be used in archaeology, geography, remote sensing, land surveying, public utility management, natural resource management, photogrammetry, urban planning, emergency management, landscape architecture, navigation, aerial video. GIS may allow to easily calculate and the movement of response resources (for logistics) in the case of a natural disaster. GIS might be used to find wetlands that need protection strategies regarding pollution. Most city and transportation systems planning offices have GIS sections.

Therefore, in a general sense, the term describes any information system that integrates, stores, edits, analyzes, shares, and displays geographic information for decision making.

GIS techniques and technology:

Modern GIS technologies use digitization (method of data creation), where a hard copy map or survey plan is transferred into a digital medium through the use of a computer-aided design (CAD) program, and geo-referencing capabilities

CARTOGRAPHY: The art or technique of making maps or charts

GEOGRAPHIC FEATURES are the features of things such as the bodies of waters, and landforms where they are on earth. Mount Everest is a geographic feature . A water fall, an island etc are some more examples.

DATABASE: A **database** is an organized collection of data for one or more purposes, usually in digital form.

SPATIAL INFORMATION: describes the absolute and relative location of geographic features.

THEMATIC DATA: data describing the characteristics of geographic features..

REMOTE SENSING

Remote Sensing is the technique of deriving information about objects on the surface of the earth without physically coming into contact with them. This process involves:

- Making observations using sensors (cameras, scanners, radiometers, radars etc) mounted on platforms (aircraft and satellites) which are at a considerable height from the earth surface.
- Recording the observations on a suitable medium such as images on photographic films and video tapes; digital data on CDs, magnetic tapes.
- Applying corrections to the data due to motion of the platform relative to earth, platform attitude, earth curvature, non-uniformity of illumination, variations in sensor characteristics . This can be done either using electro-optical techniques or by using computers.
- Generation of output products in the form of photographic enlargements with appropriate rectification.

Conventionally Remote Sensing uses electromagnetic radiation. It refers to the identification of earth features by detecting the characteristic electromagnetic radiation that is reflected / emitted by the earth surface.

Just as our eyes need objects to be illuminated by light so that we can see them, sensors also need a source of energy to illuminate the earth's surface. Different forms of electromagnetic (E M) energy are used for this purpose. Whenever E M energy falls on an object, part of it is absorbed, part of it is

allowed to pass through and the remaining is either reflected / scattered. The proportion of this distribution is different for different wavelengths of the incident energy and depends on the nature of the object.

UNIT – VII: ENVIRONMENTAL POLICY, LEGISLATION, RULES AND REGULATIONS

Contents:

National Environmental Policy,
Water (Prevention and Control of Pollution) Act – 1974;
Water pollution Cess Act – 1978;
Air (prevention and Control of Pollution) Act – 1981;
Environmental (Protection) Act, 1986
Forest Conservation Act,
Municipal Solid waste management and handling rules,2000
Treatment of solid wastes
Biomedical waste management and handling rules, 1998
Case study of Minamata disease
Hazardous waste management and handling rules 1989
Environmental Legislation
Salient features of Central Pollution Control Board

National Environmental Policy: The Govt of India constituted a Central Board for Prevention and Control of various pollution acts such as Water Act in 1974; Air Act in 1981 and Environment Act in 1986.

Several other Acts and Rules were also enacted. Accordingly, all the State Governments also constituted Pollution Control Boards in their respective States and accepted in their legislative Assemblies.

There are several loopholes in the implementation of various pollution Acts. For eg, the water courses in most of the cities carry highly noxious waters with high pollution potential. State Pollution Control Boards cannot take action against the Municipalities, Corporations , simply because they are not empowered to do so due to political system.

The Water (Prevention & Control of Pollution) Act 1974:

The Water Act 1974 was enacted in Parliament to prevent and control of water pollution and maintaining or restoring of wholesomeness of water. This Act also to prevent the pollution of water by industrial, agricultural and , municipalities including domestic waste water that can contaminate natural water resources.

Waste waters with high levels of pollutants that enter wetlands, rivers, wells etc cause serious health hazards. Individuals can do several things to reduce water pollution by avoiding chemicals for household use; reducing the use of pesticides in gardens and identifying the polluting sources .

The salient features and provisions of the Act are:

- Maintenance and restoration of quality of all types of surface and ground water.
- Establishment of State boards for pollution control.
- Prevention and control of water pollution.

Central Government resolve disputes among the States if any arise
To evolve methods of utilization of sewage and trade effluents in agriculture with proper treatment.

The Water (Pollution) Cess Act 1978:

According to Water (Pollution) Cess Act, anyone consuming water has to pay certain amount of cess depending on:

Whether the industry is using water for industrial purposes , spraying in mining areas or for boilers purpose to produce electricity.
For domestic purposes.
In processing units whereby water gets polluted and the pollutants are toxic.

However, those industries that had installed a suitable treatment plant for the treatment of industrial effluents can get a rebate of 70% on the cess payable. The major activities and provisions in the Water (pollution) cess Act can be summed up as follows:

The Water cess Act provides for setting up of National Parks, Wild life Sanctuaries etc… (Thus, as of today, there are 67 National Parks and 394 Sanctuaries in India).

Under the Water cess Act, prohibition of hunting of the endangered species was mentioned. Protection to some endangered plants like Beddome cycas, Blue Vanda Orchid , Lady Sliper Orchid, Pitcher Plant etc. is also included.

There is a provision for trade and commerce in some wildlife species with license for sale, possession, transfer etc.. This act provides legal powers to officers and punishment to offenders.

BEDDOME CYCAS BLUE VANDA
ORCHID
LADY SLIPPER
ORCHID
PITCHER PLANT

The Air (Prevention & Control of Pollution) Act, 1981:

A team of Indians attended UN conference on “Human Environment” which was held at Stockholm (Europe) in the month of June 1972. Later the Air (Prevention & Control of Pollution) Act was enacted in the Indian Parliament in 1981..

The objective of the Air Act is to establishment of Central and State Boards to prevent and control and reduce air pollution. The air act has many sections in which 19, 20, 31A, 37 plays a vital role.

Section -19 deals with the declaration of measures in case of industries to be established / already established. For eg: Dust collector, noise recorder in addition to other relevant ones are important measures to establish a crushing unit.
Section -20 deals the standards for emission of air pollutants.
Section -31A deals with the closure of industry and disconnecting the electricity.
Section – 37 deals with the penalties for violation of rules

Dust sampler / collector Sound level metre
The Air Act has made provisions for appeals. An appellate authority consisting of a single person or three persons usually appointed by the Head of the State/the Governor to hear appeals as filed by any aggrieved party (industry).
The sources of air pollution such as industries, vehicles, thermal power plants etc are not permitted to release Pb, CO, SO2; NO2; volatile organic compounds, toxic substances beyond a prescribed level.
The limits of air pollutants (micrograms / cum) in an area are as follows:

area	SO2	NO2	Pb	CO
Industrial	120	120	0.75	1.00
Domestic	80	80	1.50	5.00
Hospitals, schools	30	30	1.00	2.00

The Act is created ‘ to take appropriate steps for the preservation of the natural resources of the Earth which ensure the high quality of air and ensures controlling the level of air pollution.

The Environment (Protection) Act, 1986:

Bhopal tragedy was occurred on the mid night of 2nd Dec 1984 at the UNION CARBIDE INDIA LTD, a pesticide plant in Bhopal. A leak of methyl isocyanate gas causing a death of 3,787 people and also injured for5,58,125 people.
The Govt of India enacted the Environment (Protection) Act in the year 1986 under article 253 of the constitution. The purpose of the Act to provide a frame work on water, air, land and the inter-relationships with the human beings and other living micro-organisms…
The Act came into force on Nov, 19th 1986, the birth anniversary of late Prime Minister Indira Gandhi, who was a pioneer of environmental protection issues in India. Some important features of this Act are:
The central Government put restrictions on an area in which any industry or operations shall not be carried out without any safe-guards.
Emissions and effluents standards in respect of 61 categories of industries have been evolved and notified.
Who ever fails (or) violate the environmental pollution Act, be punishable with imprisonment upto 5 years or with fine which may extend to one lakh rupees or both.
Those industries who require consent under the Environment Act are required to submit an environmental audit report to the concerned Environment Board on or before 30th Sep every year.

Forest (conservation) Act 1980

Forest is a biotic community composed predominantly of trees, shrubs, bushes etc. whereas forest produce includes timber, charcoal, oils, resins, tree bark, seeds, fruits , flowers, grass, honey, wax etc. Increasing population is causing for decrease in biotic community ie forests and implementation of forest conservation is essential and mandatory. Forest (Conservation) Act was enacted in the parliament in 1980.
The State Governments or other agencies (eg ITDA) cannot violate the Forest (Conservation) Act unless prior approval by the Central

Government. The objectives of the Forest (Conservation) Act are:
Restrictions on preservation of forests and use of forest land for other purposes.
Forest land or any portion thereof may not be used for non-forest purposes.
Forest land may not be assigned by way of lease to a private person or to any corporation / agency.
Forest land may not be cleared off trees which have grown naturally in that land.
However, according to Section 32 of Forest (Conservation) Act, the State Governments can make avail the use of :
Removal of forest produces, conversion timber etc for proper utilization
Granting of license to the agencies / inhabitants to collect timber and forest produce for their own use.
Granting of license to persons for felled trees / timber and other forest produces for trade purposes.
The Forest (Conservation) Act also include:
Prohibition of hunting, shooting, fishing, poisoning of water in forest areas.
No clearance of forest land for cultivation or other purposes
Protection of timber from fire.

Municipal Solid Waste (Management and Handling) rules 2000:

Central Government notified in the sections of 3, 6 and 25 of the Environment (Protection) Act 1986 with the objective of regulating the management and handling of the Municipal Solid Wastes.
Municipal solid waste generate in residential and commercial areas. Residential wastes include garbage, unused house hold items, pieces of clothes, rotten vegetables etc while commercial establishments generate different wastes depending upon the type of activity. For eg: shops and other establishments generate wastes containing large quantity of paper, and cardboard packing cases .
The wastes from streets are also part of the municipal solid wastes. Street wastes are classified into 3 main categories – natural waste, road traffic waste and behavioral waste.
Natural wastes include the dust blown from unused lands / roads.
Road traffic waste originate from transport vehicles. The motor vehicles while moving on the road deposit petrol, oil at sometimes and still their contents (grease, lubricants) on roads.
Behavioral wastes originate from wastes thrown by pedestrians using the streets and the wastes from adjoining houses, shops which spill out due to improper storage.

Municipal Solid Waste Management:

It is estimated that 291 class I and 345 Class II towns together generate 52000 tonns of Municipal Solid Waste per day in India. Solid wastes are generated @ 10,000 tons /day in all the 117 municipalities / corporations of Andhra Pradesh. To minimize the municipal solid waste, the Municipal

authority made an implementation of Management plan as per Schedule – I.
Any municipal solid waste generated in a city or a town, shall be managed and handled in accordance with the procedure laid down in Schedule - II.
The waste processing units and disposal facilities are to be set up by the municipal authority on their own or through an operator shall meet the specifications and standards as specified in schedule – III.
Treatment of solid wastes: Basically there are 3 types of disposal techniques practiced in Municipal solid wastes.
(i) Sanitary Land Fill
(ii) Composting
(iii) Incineration.
(i) Dumping the solid waste at the out-skirts of the city, especially in low lying areas, or on either side of the road is very common. In case of mineral excavations, granite quarries or soil excavation for brick making, low lying areas are created. *Restoration to original level with solid wastes is a good example for sanitary landfill.*
(ii) Decomposition of solid waste material is known as **composting and the final product is called *compost.*** Compost contains nutrients (NPK) for the growth of plants. A few methods of treatment and disposal of composting system are given below:
The composting systems can be broadly grouped as aerobic and anerobic. Composting systems can be operated either manually or mechanically in open pits or in enclosed digesters in addition to natural process.
Aerobic composting is a process in which bacteria, actinomycites, fungi and other biological forms are actively involve. Aeration is a natural process occurs on the surface areas of the composting mass, while the inner layers tend to progressively turn anaerobic.
Trench method is best suited for flat land where excavation can be carried out easily. A trench 2 mts deep with 5 mts length and 2 mts wide is cut. The excavated soil is placed on the sides of the trench and the trench is filled with solid waste refuse in layers and finally with a soil cover .
Area method is best used in areas where natural depressions exist as in quarries, valleys. The waste is put in the natural depressions and compacted a layer of soil is thrown on top. The process is repeated till the depression is filled up.
(iii) Incineration is a common sight to see small fires of burning dry leaves, paper etc on the sides of roads. However, such fires produce considerable smoke and air pollution.
Increasing population and rising standard of living styles create the solid waste and require integrated policies/rules and technologies.
Biomedical Waste (Management and handling) rules, 1998:
Biomedical waste is also known as Hospital waste which is generated during the diagnosis, treatment, immunization of human beings or animals; in research activities or testing of biological aspects. It may also include

wastes like anatomical waste, culture waste, discarded medicines and chemical wastes. It is also in the form of disposable syringes, broken glasses, bandages, body fluids, human excreta etc .

It has been roughly estimated that of the 4 kg of biomedical waste generated in a hospital at least 1 kg would be infected. Surveys carried out by various agencies show that due attention is not given to Biomedical waste management.

After the notification of the Bio-medical Waste (Handling and management) Rules, 1998 establishments are slowly streamlining the process of waste collection, segregation, treatment, and disposal.

The biomedical handling rules will apply to hospitals, Nursing Homes, Veterinary Hospitals, animal Houses, Pathological labs and Blood Banks.

Management of Biomedical waste:

Producers who are generating the bio-medical waste need to install an appropriate facility in their premises to ensure that biomedical waste should be collected in accordance with Schedule – I.

The biomedical waste need to be segregated into containers or bags at the point of generation in accordance with Schedule – II, prior to its storage, transportation, treatment and disposal.

The containers shall be labeled according to Schedule - III.

The biomedical waste which is generated by means of various activities shall be handled without any adverse effects to the human health and the environment.

Hazardous Waste (Management and handling) rules, 1989:

It is a waste that makes it dangerous to human health or the environment. Hazardous wastes can be liquids, solids, gases or sludges. Waste products that are either infectious or radioactive also belong to hazardous category. The other hazardous wastes include Arsenic, Barium, Chromium, Lead, Mercury, Selenium, DDT (Dichloro Diphenyl Trichloro ethane) substances.

Hazardous waste is defined based on physical or chemical properties of toxicity, reactivity, ignitability and corrosivity of wastes.

- **toxic wastes** are harmful when a toxic substance combine with ground water.
- **reactive wastes** (Lithium-sulphur batteries; gun powder; nitroglycerine; explosives etc cause explosions, when heated or compressed or mixed with water) ;
- **Ignitable wastes** (gasoline, paint thinners; alcohol; waste oils; solvents etc create fires under certain conditions);
- **corrosive wastes** (Acids or Bases that are capable of corroding metal containers such as storage tanks, drums and barrels);

Hazardous waste is regulated under the Resource Conservation and Recovery Act (RCRA) - Subtitle C. The hazardous waste are listed into three categories:

The F- list (waste generate in non-specific units at source points) : Wastes generate during manufacturing of substances in industries such as solvents

that have been used in cleaning operations.
The K – list (waste generate in specific units at source points): Wastes generate from specific industries such as petroleum refinery or pesticide manufacturing units.
The P – list and the U – list (discarded products): Wastes include specific commercial chemical products in an unused form. Some pesticides and some pharmaceutical products become hazardous waste when discarded. Wastes included on the P- and U-lists can be found in the regulations at 40 CFR - 261.33 .
Handling Rules:
The lead acid batteries should cover with a cap.
Records are to be maintained for disposal of hazardous waste (collection, treatment, transport, storage and disposal operations) in Form 3.
The producer shall send annual returns to the State Pollution Control Board in Form 4.
Where an accident occurs at the hazardous waste site or during transportation of hazardous wastes, the occupier or operator of a facility shall report immediately to the State Pollution Control Board about accident in Form 5.
Case study: Environmental problems caused by hazardous wastes:
A large plastic plant located near the Minamata bay used a mercury containing compound in a reaction to produce Vinyl Chloride , a common plastic material. The left – over mercury was dumped into the Bay along with other wastes from the plant.
Though the mercury was in its less toxic inorganic state when dumped, the micro organisms at the bottom of the bay converted the mercury into its organic form. This organic mercury then entered into the tissues of fish which were, in turn consumed by the people living in the area.
The contaminated fish thus caused an outbreak of poisoning, killing and affecting several people. Mercury poisoning is thus called MINAMATA DISEASE.
Environmental Legislation & Pollution Control Acts in India
The term “Environmental Legislation” refers to the management of the environment under a strong legal frame work to help and protect the environment. Environment was first discussed in the “United Nations Conference on “Human Environment” in Stockholm (Europe) on 5th June 1972 and thereafter 5th June is celebrated all over the world as “WORLD ENVIRONMENT DAY”. India is the first country in the world to have made provisions for the Protection and Conservation of Environment in its Indian Constitution.
Under Article 47 of the Constitution, the States shall ensure the raising of the level of nutrition and the standard of living of its people and the improvement of public health and, in particular, the State shall endeavour to bring about prohibition of the consumption (except for medicinal purposes) drinks and of drugs which are injurious to health."
Under the article 48 – A of Indian Constitution, the states shall Endeavour to

protect and improve the environment and to safe guard the forests and wildlife of the country.

Article 51 – A (g) reads as follows " It shall be the duty of every citizen of India to protect and improve the natural environment including forests, rivers, wild life.

The Govt of India has formulated about 30 acts and rules related to the environment. The environmental legislations passed by Govt of India are enlisted below:

1. The Water (Prevention & Control Pollution) Act, 1974
2. The Water (Prevention & Control Pollution) Cess Rules 1978
3. Forest (Conservation) Act 1980
4. The Air (Prevention & Control Pollution) Act, 1981
5. The Air (Prevention & Control Pollution) Rules 1982
6. The Air (Prevention & Control Pollution) for Union Territories Rules Act 1983.
7. The Environment (Protection) Act, 1986
8. The Environment (Protection) Rules 1986
9. Hazardous Wastes Rules 1989
10. Manufacture and storage of hazardous chemical Rules, 1989
11. The Public Liability Insurance Act 1991
12. The Public Liability Insurance Rules 1991
13. The National Environment Tribunal Act, 1995
14. Bio medical waste, Rules 1998
15. Re-cycled plastics manufacture and usage Rules, 1999
16. Dumping and disposal of Fly ash --- notification
17. Noise Pollution Rules 2000
18. Municipal solid wastes Rules 2000
19. Ozone depleting substances rules 2000

Salient features of CPCB (Central Pollution Control Board):

The Central Pollution Control Board is a statutory organization, was constituted in Sep 1974 under the Water (Prevention and Control of Pollution) Act, 1974. CPCB provides technical services to the Ministry of Environment and Forests. The principal functions of the CPCB are:

- It advises the Central Government in matters related to prevention and control of water pollution.
- To improve the quality of air and to prevent control air pollution in the country.
- Organizes training programmes for prevention and control of pollution.
- Collects, compiles and publish the technical data and statistical data related to pollution.
- Lays down standards of water quality parameters.
- Establishes and recognizes laboratories for analysis of water, sewage samples.
- CPCB has an automatic monitoring station in New Delhi. At this station RSPM (Respirable Suspended Particulate Matter); CO; O3; SO2; NO2 etc are being monitored regularly.

One of the mandates of CPCB is to collect, consolidate the statistical data relating to water pollution. Hence, Water Quality Monitoring (WQM) is utmost

importance. The State Pollution Control Boards (SPCB) also have similar functions to be executed at State level and are governed by the directions of CPCB.

Acids Acids**:** A substance that liberates hydrogen ions (H) in solution and reacts with base to form salt and water only.

Many acids are corrosive and sour taste.

Bases A substance that liberates hydroxyl ions (OH) in solution and reacts with acids to form salt and water only

DDT Dichloro Diphenyl Trichloro ethane

enacted As per norms

Legislation Group of laws

Policy A set of ideas / plans

regulations An official rule that controls something

Rules An official instruction(s)

Solvent A substance, usually a liquid, capable of dissolving another substance

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UNIT – VIII : TOWARDS SUSTAINABLE FUTURE

CONTENTS:

Sustainable Development ___ Concept

____ Measures

___ Threats

Population and its explosion

Strategies for achieving sustainable development:

Environmental Education

Urban Sprawl

Conservation of Resources

Over-exploitation of resources

Sustainable cities and sustainable communities

Human Health

Role of Information Technology in environment

Environmental Ethics

Concept of Green Buildings

Clean Development Mechanism

Family Welfare Programmes_____ Family Planning

Salient features of Human Rights

HIV infection / modes of transmission of HIV

Carbon Trading

Cybernetics

Sustainable Development means improvement of quality of life with continuous progress without exhausting natural resources. Society of the population must require to meet the needs by managing the natural resources efficiently and maximizing the benefits from them so as not to overload the world's ecosystem.

Sustainable development implies using the natural resources in such a manner which doesn't eliminate or diminish their usefulness for future generations eg: coal, crude oil; forests_. Hence, the concept of Sustainable Development could be termed development without destruction.

Measures for Sustainable Development: Following are the measures for the

sustainable development:
1. Population Control: Population growth should be limited to the desirable level. Slow human population growth, reduce the stress on global life.
2. Biodiversity ((variety of life on earth and how the living things interact with each other) must be conserved.
3. Recycling of wastes: Recycle at least 60% of the materials which are discarded now as trash.
4. Reduced Consumption: Lifestyle should be shifted to lesser consumption of resources.
5. Efficient usage of Resources: Resources should be renewed or reused. For eg: solar energy should be encouraged.
6. Water Resource Management: Some of the consequences of poor water resource management such as
(A) River flooding; (B) Silting of reservoirs, ponds, lakes;
(C) over exploitation of groundwater; (D) Water logging by over irrigation
(E) Improper drainage (F) Pollution of water bodies
are to be taken up for implementation. So, Sustainable development insists optimum management of water resources locally and globally.
7. Integrated Land use planning: Using lands for agriculture, forestry, fodder cultivation, industrial growth, traffic etc should be planned
8. Creating Awareness: Creation of environmental awareness and spreading environmental education among the people is must for fruitful results..

THREATS TO SUSTAINABILITY: Though the measures are adopted for implementation of Sustainable Development , some of the threats such as Energy depletion; climate system collapse; ecological collapse; Economic slump etc are reduce the sustainability of life.

Energy depletion: The availability of crude oil resources are less and usage is more and more. Since the increased number of human beings mainly dependent on energy source especially fossil fuels, the future generation will have to work hard to restructure the way they live.

Climate system collapse: Huge quantities of Green House Gases have been releasing into the atmosphere over the last 100 years. And more is being released every day, future generation may be unstable with the climate systems of floods, storms, droughts, extreme temperatures etc_

Ecological collapse: Numerous industries are coming up by consuming the natural resources and releasing the toxic substances into the atmosphere. These substances cause soil pollution, air pollution; water pollution and in turn causing the imbalance of ecosystem.

Economic slump: Although the world has never had an economic recession all over, there may be a global economic depression may takes place because of the destruction of ecosystem. .

POPULATION GROWTH AND POPULATION EXPLOSION:

Population growth is the change in population over a period of time.
Population Growth Rate (PGR) is the rate at which the number of individuals in population increases over a unit time period.
Population Growth Rate =
(population at end of the period – population at beginning of the period)
population at beginning of period)
Population growth rate varies greatly among regions and even among

countries within the region. Any country depends upon the PGR for its development and "a developed country is one that allows all its citizens to enjoy a free and healthy life in a safe environment".

Japan in Asia; Canada and the United States in northern America; Australia and New Zealand; Western Europe; Israel are considered "developed" regions or areas.

Countries such as Italy, Portugal, Russian Federation ; India; Sri Lanka and Spain have rate of population growth is near zero and are included under "developing regions"..

On the other hand, according to the classification from International Monetary Fund (IMF) 2004, all the countries of Eastern Europe as well as the former Soviet Union (USSR) countries in Central Asia (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan) and Mongolia were not included under either developed or developing regions, but rather were referred to as "countries in transition"; however they are now widely regarded (in the international reports) as "developing countries".

INDIA PRESENTS A MIXED PICTURE, WITH HIGH FERTILITY RATES IN THE NORTH OF THE COUNTRY AND LOW ONES IN THE SOUTH. Family planning services and high levels of education among women have supported declining fertility rates in southern India and Sri Lanka .

While Pakistan's fertility rates remain high, family size in Bangladesh is now steadily declining.

As far as the size of population is concerned, India ranks second in the world, next to China. India's landscape is 2.4% of the total world area whereas its population was 16.2% of the world population (1991 census).

POPULATION GROWTH (2010)

COUNTRY / REGION Population Growth Rate (%)

COUNTRY / REGION Population Growth Rate (%)

JAPAN -0.1 BHUTAN 1.7
HUNGARY -0.26 NEPAL 1.8
RUSSIA -0.47 SOMALIA 2.3
SRILANKA 0.9 KENYA 2.6
BANGLADESH 1.1 ETHIOPIA 2.7
CAMBODIA 1.1 MADAGASKAR 2.9
VIETMA, 1.1 TANZANIA 3
NEW ZEA;AMD 1.2 UGANDA 3.24
INDIA 1.3 AFGHANISTAN 3.85
MALDIVES 1.3 BURUNDI 3.9
TAJAKISTAN 1.4 LIBERIA 4.5
MANGOLIA 1.6
ZAMBIA 1.6
AUSTRALIA 1.7

Population Explosion:

Sudden increase in population is called as Population Explosion. India is now passing through the phase of population explosion. Rapid growth of population causes poverty and proves to be a barrier to development.. The reasons of Population Explosion are:

illiteracy
Poor Family Planning awareness but better health care facilities
increase in agricultural and industrial productivity

IMPACT of Population Explosion: Population Explosion causes Poverty; Malnutrition; Environment degradation; Over exploitation of natural resources; Spread of diseases; Economic inequity; more disposal of garbage; sanitation problems etc..

Problems of Population growth/ Population explosion:

Rapid population growth will over stress the earth's natural resources and crowded out undomesticated plant and animal species. Hence, population explosion is causing severe resource depletion and environmental degradation.

Sources like water, fossil fuels, minerals etc are limited and due to over exploitation these resources are getting exhausted. In addition forests, grass lands etc.., are under tremendous pressure. Industrial and economic growth are raising the quality of life but adding toxic pollutants into the air, water and soil.

As population increases, more resources are needed to meet basic requirements. At the same time people consume these resources of they produce waste that is again put back into the air, land and water. The greater amount of waste from larger populations puts more stress on ecosystems.

Highest Population growth rates are found especially in developing countries but the G7 nations (the US, Canada, Britain, France, Germany, Japan & Italy) represent only 10% of global population but consume over 40% of the earths fossil fuels as well as most of the worlds commodities and forest products. Though consumption rates are high in these countries, even small increases in population can have a significant impact.

As the worlds population continuous to grow geometrically, great pressure is being placed on land, water, energy and biological resources to provide an adequate supply of food.

Water is critical for all crops and require during the growing season . About 87% of the worlds fresh water is consumed or used up by agriculture and thus is not recoverable. Water resources are under greater stress as populous cities and states require water from rivers, lakes as aquifers ever year.

Fossil energy is another prime resource used for food production. The intensive farming technologies of developed countries use massive amounts of fossil energy for fertilizers, pesticides, irrigation and for machines as a substitute for human labour.

Every second, on an average of 4 to 5 children are born and 2 people die, thus resulting a net gain of 2 persons every second. This means that every hour we are growing by about 7200 persons and everyday by about 1,72, 800 persons and this is called as the **population clock.**

STRATEGIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT:

The World Summit on "Sustainable Development" 2002 reiterated (to say something again so that people take notice of it) all countries to make progress in the formulation and elaboration of National strategies such as environmental education, urban sprawl, conservation of resources etc for Sustainable Development.

ENVIRONMENTAL EDUCATION:

Education plays a very important role in dealing with the global issue.

Environmental Education is an integral process, which deals with man's interrelationship

with his (natural and man made) surroundings viz., relation of population, pollution, resource allocation, resource depletion, conservation, technology ; urban and rural planning.

Environmental Education is intended to promote the awareness and understanding of the environment among the citizens. Hence, Environmental Education is meant to bring about the required changes in knowledge, understanding attitudes and skills pertaining to the environment, conservation and ecological balance.

So, Environmental Education must be considered as a solution for all environmental problems and the goal of Environmental Education should be to improve and enhance the quality of life.

The objectives of Environmental Education are:

Awareness--- to help individuals acquire an awareness of environment and its allied problems.

Knowledge--- to acquire basic understanding of the environment

Skills--- to acquire the skills for solving environmental problems.

Participation-to develop responsibility regarding environmental problems to ensure appropriate action to solve those problems.

Importance of Environmental Education: The importance of environmental protection has long been recognized in our country. Article 51 (g) of the constitution states " It shall be the duty of every citizen to protect and improve the Natural environment including forests, lakes, rivers, wild life" etc..

Education about environment provides learners with the know how on environment. Education for environment will be concerned about conservation, preservation and upgradation.

Conservation of Natural Resources: As the human population increases, greater demands are placed upon the available natural resources. Large areas of the earth are being converted for the exclusive use of man. Thus, many valuable natural resources, which were available yesterday are not seen today. At present, world environment is suffering critical stress not only by utilization of natural resources but also with the environmental damage inflicted by deforestation, species loss and climate change. So, a new environmental ethic with responsibility is required to recognize the earth's limited capacity of natural resources. This ethic must motivate the people to effect the needed changes.

The global population had already crossed 6 billions and may reach 8 billions by 2019 while the per capita availability of forests, pasture lands, crop lands etc will be decreased. Resources consumption in developed countries causes significant pollution problems, environmental degradation and resource depletion. For eg: an average US citizen consumes 50 times as much as the average citizen of India.

Hence, there must be a holistic way of thinking regarding the management of land resources, water resources, forest resources etc..

Over-exploitation of resources: The over-use or over-harvesting of plants, animals or natural resources threatens the Earth's biodiversity is called as overexploitation. Over-exploitation causes diminishing of resources which include medicinal plants, forest wood, grazing pastures, fish stocks, forests; water aquifers and species extinctions. If over-exploitation is sustained, it can lead to the destruction of the environment.

Over-hunting has been a significant cause of the extinction of hundreds of

species including whales large mammals etc. Commercial hunting, both legal and illegal is the principal threat.
Deforestation, Desertification, Extinction of species; Soil erosion; Fossil fuel depletion; Ozone depletion; increase of Green House Gases etc may arise from over-exploitation of natural resources.

URBAN SPRAWL

The spreading of houses and shopping centers on undeveloped land near a city is called as Urban Sprawl.
Basically the rapid growth and spread of big cities takes place where the consumption of land is faster than the population growth. The rapid growth of population causes environmental problems such as increase in pollution, smog, pollution from vehicles, increased water usage, energy consumption, and the loss of animals and their natural habitats. This has become a very serious problem because these suburban areas take up a lot of land that could be otherwise used for agriculture.
Urbanization refers to migration of population from rural regions to towns and cities. Man has always moved to new places in search of better opportunities. Hence, migration is not a new phenomenon. However, recent studies have shown a steep rise in urbanization in the late 19th and early 20th century. This sudden increase in urbanization can be attributed to Industrial Revolution, which provided better economic opportunities in the cities, due to setting up of factories and industries. Cheaper land and housing costs in the suburbs as compared to urban centers to settle in urban sprawl areas. There has been an increase the development of infrastructure like roads, water and electricity in the suburbs than in existing urban centers, thus adding benefits to urban sprawls.
There has been an increase in commercial lending practices that favor suburban development. Sprawls are characterized by low density populations and less traffic congestion. Higher property and business taxes in the cities have pushed businesses to the suburbs where taxes are generally low.
Effects: Sprawls have been criticized for increasing public costs where public money is being spent on redundant infrastructure outside the urban areas at the cost of neglecting the infrastructure in the cities that is either not utilized or underutilized. Populations living in urban sprawls commute to cities in their automobiles. This has resulted in heavier traffic on the roads leading to traffic congestion, increase in air pollution and automobile related accidents.
Increasing dependence on automobiles has led the sprawl population to use their vehicles even for short distances. Such behavior is believed to have led to increase in obesity and hypertension, in the population living in sprawls than those in the cities.
Due to heavy dependence of people residing in sprawls on automobiles, city planners are compelled to spend more money on larger highways and parking spaces. This is considered as an additional burden on the state treasury as this reduces the area of taxable land.
Urban sprawl is the later stage of urbanization and is an inevitable phenomenon. Just like every other process urban sprawl has its own pros and cons. However, the negative aspects of urban sprawls can be neutralized by monitoring their growth in a planned way, so that they are not a liability either to the society, economy or the environment.
Sustainable cities and sustainable communities:

A sustainable city, is a city designed with consideration of environment impact, to minimize required inputs of energy, water, food and waste and also to reduce the outputs of heat, emissions of CO2, methane . Richard first coined the term "ecocity" in his 1987 book, "Ecocity Berkley: *building cities for a healthy feature".*
The crux of this is to create the possible ecological foot print, and to produce the lowest quantity of pollution; to efficiently use land; recycle conversion of waste to energy, and thus the city's overall contribution to climate change will be minimal .
It is estimated that around 50% of the worlds population now lives in cities and urban areas. In order to make achievements, building design and practice, as well as perception and lifestyle must adopt sustainability thinking.
Practical achievements: These ecological cities are achieved through various means such as:
□□Zero-emission transport
□□Zero-energy building
□□Sustainable urban drainage systems
□□Energy conservation systems/devices
□□Xeriscaping – garden and landscape design for water conservation.
The industrial park in Kalundborg is often cited as a model sustainable city in Denmark.
India is working on Gujarat International Finance Tec-City (GIFT) which is an under construction world class city in Gujarat. It will come up on 500 acres (2.0 km2) of land. It will also be first of its kind fully sustainable city.
Sustainable communities are communities planned, built to promote sustainable living. A sustainable community is one that:
□□Acknowledges that economic, environmental and social issues are interrelated and that these should be addressed "holistically". (Treating the whole of something and not a part of it).
□□Understands and begins to shift away from polluting and wasteful practices.
□□Considers the full environmental, economic and social impacts of development and community operations.
□□Understands its natural, cultural; historical and human assets and resources and acts to protect and enhance them.
□□Promotes resource conservation and pollution prevention.
□□Focuses on improving community healthy and quality of life.
□□Acts to create value added products and services in the local economy.
Human Health: Health is the general condition of a person in all aspects. It is also a functional, metabolic efficiency of an organism.
Public health problems caused by environmental contamination and emerging infectious diseases are a growing concern worldwide. These public health threats are affected by the relationship between people and the physical, chemical and biological nature of our natural environments.
Vector borne and Zoonotic diseases; water contaminants; airborne contaminants Environmental threats to public health require marshalling of all our scientific knowledge and know-how to develop new solutions.
The Nation's natural science agency, play a significant role in providing scientific knowledge and information that will improve our understanding of the environmental contributions to disease and human health.
ROLE OF INFORMATION TECHNOLOGY IN ENVIRONMENT
Information Technology has tremendous potential in the field of environmental

education as in other fields like business, economics, politics. Development of Internet facilities, World Wide Web, Geographical Information System through satellites has generated a wealth of up to date information on various aspects of environment. A number of software's have been developed for environment and health studies in understanding the subject especially in India.

(a) Prediction of any natural calamity through the use of IT: Population in a State or country will be subjected to many environmental disasters. Scientists study and predict the same through information technology and express the possible occurrence of the natural disaster quite before.

The predictions about any disaster that is about to occur in a short time, in future should be studied well and the information about the forthcoming disaster should be informed to all people through the information technology or e – communication.

(b) Public awareness of environmental disasters through the information technology: Whenever any environmental disaster occurs, people concerned should prepare to do some activities to minimize the affects and it is possible only through I.T.

(c) Database on Environment: It is usually in computerized form and can be retrieved whenever required. Database is also available for diseases like HIV / AIDS, malaria etc..

The Govt of India under the Ministry of Environment and Forests established an Environmental Information System (ENVIS) as a plan & to provide environmental information to scientists, engineers, research workers all over the country.

National Management Information System (NMIS) under the Dept of science and Technology has compiled a database on Research and Development projects related to environmental information on environmental pollution (eg: ground water pollution, marine pollution, forest destruction etc).

ENVIRONMENTAL ETHICS is a branch of philosophy that considers the moral relations between human beings and their natural environment. Environmental Ethics is concerned with the morality (right or wrong) of human actions as they affect the environment where we live in.

Environmental Ethics deals with issues that are related to how we utilize and distribute resources. There are many ethical decisions that human beings make with respect to the environment. For example:

- Should we continue to cut the forests for the sake of human consumption?
- Should we continue to propagate?
- What environmental obligations do we need to keep for future generations?
- Is it right for humans to knowingly cause the extinction of a species for the convenience of humanity?

CONCEPT OF GREEN BUILDING:

Green Building, is also known as Green Construction is the practice of creating structures such as design, construction, operation, maintenance, renovation etc throughout a building's life cycle. Green building helps to preserve the external environment and provides great benefits to humans through the use of safe building materials, efficient use of natural resources, human safety etc..

The most fundamental benefit of Green Building is that it is environmentally friendly and safe for people occupying the building. Its aesthetic design and well architectural features such as sufficient safe, proper layouts and pleasant lighting to people. While, elements such as clean air, clean water make it safe and beneficial to human health.

Another important benefit of Green Building is Energy efficiency which results in reduced energy consumption for AC and Heating needs. Effective use of natural lighting, cool roof and wall panels which leads directly cost savings to the building owners.

The use of Solar Energy in green building can provide free electricity for the building owners. Solar panels can be installed on the roof top of the building where the solar energy will be converted to electricity.

Another way to generate electricity is through the use of wind energy by setting in pathway of winds

CLEAN DEVELOPMENT MECHANISM

With the Kyoto Protocol becoming legally on 16 February 2005, the Clean Development Mechanism (CDM) is a key instrument for limiting greenhouse gas emissions (GHG) and promoting sustainable development. For both developing and developed countries to benefit from the CDM, it is important to establish increased awareness and understanding of its various aspects. A CDM project should result in a net decrease of Green House Gases emissions.

The Clean Development Mechanism defined in article 12 of the Protocol, under the Kyoto Protocol to implement an emission-reduction projects in developing countries.

The **CDM** allows in developing countries to earn certified emission reduction (CER) credits, each equivalent to one tonne of CO2. These CERs can be traded and sold, and used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol.

The CDM is the main source of income for the UNFCCC Adaptation Fund, which was established to finance adaptation projects and programmes in developing countries particularly vulnerable to the adverse effects of climate change. The Adaptation Fund is financed by @ 2% levy on CERs issued by the CDM.

A CDM Project activity might involve, for eg , a rural electrification project using solar panels or the installation of more energy – efficient boilers.

From a business point of view, CDM represents new opportunities for entrepreneurs in the developed countries.

Family Welfare Programmes & the importance of Family Planning:

According to Charles Darwin, every living organism is mainly interested in two activities of life. They are (1) .Feeding and (2) Breeding. In case of human beings this rule is applicable and it was found to be true.

In olden days, people have many children because of joint families since all people use to live together and they do not have separate individual families of their own. In recent years, people have realized the importance of family welfare through family planning specially in limiting the number of children irrespective whether they are boys or girls.

India launched the National Family Welfare Programme in 1951 with the objective of "***reducing the birth rate to stabilize the population at a consistent level***". As per constitution of India, Family planning is being implemented under five year plan programmes as :

I & II Five Year Plans were mainly ***"clinical"*** under which facilities for providing of services were created. On the basis of data brought out by the 1961 census, clinical was replaced by "***Extension and Education Approach***" along with a spread of message of small family during III Five Year Plan. In the IV Five Year Plan (1969-74), high priority was accorded to the family welfare programme and was proposed

to reduce birth rate from 35 per thousand to 32 per thousand by the end of the plan. The objective of the V Five Year Plan (1974-79), was to bring down the birth rate to 30 per thousand. The name of the program was changed to family welfare from family planning with no force or coercion or compulsion etc..,

In the VI Five Year Plan (1980-85), family planning methods of sterilization, IUD insertions, C.C, Oral Pills etc.., were implemented by achieving the following:

□□Reduction of average size of family from 4.4 children to 2.3 children.

□□Birth rate to 21 from the level of 33 and death rate from 14 to 9 and infant morality rate from 127 to below 60.

The family welfare program during VII Five Year Plan (1985-90), was to provide facilities or services nearer to the door steps of population by establishing subcenters, sub-district level hospitals, universal immunization programs etc.., The VII Five Year Plan was continued during 1990-1992.

To impart new dynamism to the family welfare program, so many ongoing schemes were revamped in the VIII Five Year Plan. Enhanced allocation of financial resources, amounting to Rs.50 lakhs per year per district was made for upgradation of health infrastructure from 1992-93 to 1995-96. This amount is being used for providing well equipped operation theatres, labor rooms, a six bedded wards and residential quarters for paramedical workers.

The targets fixed for the VIII Five Year Plan of a National level birth rate of 26 was achieved by all states except Assam, Bihar, Haryana, M.P, Orissa, Rajasthan & U.P. Reduction in the population growth rate has been recognized as one of the objectives during the IX Five Year Plan.

The strategies during the IX Five Year Plan were to assess the needs for child health at Primary Health Center (PHC) level and to provide high quality, integrated reproductive and child health care.

Family Planning: Modern science has provided several birth control techniques including surgical methods, chemical pills and other family planning methods. More than a hundred contraceptive methods are on trial.

The United Nations Family Planning Agency provides funds to 135 countries. Many of these countries include abortion as a part of the population control programme which very often encourages female infanticide there by disturbing the optimal male, female ratio in a society. The birth control programs have often faced strong opposition from religious groups.

Salient features of the universal declaration of Human Rights by UNO

On December 10th, 1948 the general assembly of the United Nations Organization (UNO) adopted and proclaimed the universal declaration of Human Rights.

The Universal Declaration of human rights as a common standard of achievement for all peoples and all Nations, keeping this declaration constantly in mind to promote respect for these rights and freedoms to secure their universal and effective recognition among the peoples of Member States themselves and among the peoples of Territories under their jurisdiction. The following is a list of typical human right issues monitored as programs by the National Human Rights Commission in India:

Article-1: All human beings are born free and equal in dignity and rights..

Article-2: Everyone is entitled to all the rights and freedoms set forth in this declaration without distinction of any kind such as color, sex, language, religion, political, national, property, birth etc..,

Article-3: Everyone has the right to live, liberty and security.

Article-4: No one shall be held in slavery.
Article-5: No one shall be subjected to torture or to cruel or punishment.
Article-6: Everyone has the right to recognition anywhere as a person before the law.
Article-7: All are equal before the law.
Article-8: Everyone has the right to an effective remedy by the competent National Tribunals for acts violating the fundamental rights granted him by the constitution or by law.
Article-9: No one shall be subjected to arbitrary arrest or detention.
Article-10: Everyone is entitled in full equality to a fair and public hearing by an independent in the determination of his rights.
Article-11: Everyone charged with a penal offence has the right to be presumed innocent until proved according to law.
Article-12: No one shall be subjected to interference with his privacy, family and correspondence.
Article-13: Everyone has the right to freedom of movement and residence within the borders of each state. Also has the right to go any country including his own and to return to his country.
Article-14: Everyone has the right to seek and to enjoy in other countries.
Article-15: Everyone has the right to a Nationality.
Article-16: Men & Women of full age without any limitation to marry as to form a family. Marriage shall be entered into only with the free and full consent of the intending spouses.
Article-17: Everyone has the right to own property alone.
Article-18: Everyone has the right to freedom of thought, belief in religion, worship and observance.
Article-19: Everyone has the right to freedom of opinion and expression.
Article-20: Everyone has the right to freedom of peaceful assembly or association

Process of HIV infection / the modes of transmission of HIV and prevention for control of AIDS in India

Human populations suffer from many types of diseases. These diseases are either transmissible or non-transmissible. Populations have been suffering from many centuries due to transmissible diseases like Malaria, Filarial etc through mosquitoes. HIV stands for **Human Immuno Deficiency Virus**, the virus that causes ***Acquired Immuno Deficiency Syndrome*** (**AIDS)**. AIDS is a result of the HIV virus. It is not a disease but a weakness in the body and unable to fight off illness. AIDS is the most serious stage of HIV infection. It results from the destruction of the infected persons immune system.

All human beings being unisexual in nature with men and women should come together and engage themselves in health conditions. The HIV is generally transmitted from one person to the other through sexual act apart from the transfuse of blood which contains HIV also.

HIV is a syndrome with group of diseases that affect the immune system of the body thereby the infected person will be suffering from many diseases and leads to death. There is no medicinal control for AIDS virus only method is prevention. People who are infected with HIV may not have any symptoms for many years. However, following are the signs of infection with HIV::

Rapid weight loss
Dry cough; Fever ; Fatigue
Swollen lymph glands

Diarrhea for more than a week; Pneumonia
White spots or blemishes on the tongue or in the mouth
Memory loss; Depression and other neurological disorders.

Transmission of HIV: It occurs when body fluids of an infected person enters the body of an uninfected person. HIV enter the body through a vein (eg: Injection), the anus, the vagina, the penis etc.., HIV is also transmits from one person to another:

- By having sexual intercourse with an HIV-infected person.
- By sharing needles who is infected with HIV.
- From HIV-infected women to babies before or during birth or through breast feeding after birth.
- Through transfusions of HIV infected blood.

HIV & AIDS in India: India had a sharp increase in the HIV infections from 3.8 million in 1990 to 4.6 million children & adults with HIV/AIDS in 2002. India has a large population and population density, low literacy levels and lack of awareness at low levels, HIV/AIDS is one of the most challenging public health problems ever faced by the country.

Methods suggested for prevention of occurrence of HIV/AIDS:

By controlling the sexual habits
Avoiding sex with unknown partners
By using a condom during the sex
Avoiding the injections from unsterilized syringes
By using a new needle every time for having an injection
Avoiding blood transfusion, if necessary with thorough check before transfusion
By checking the Blood banks
Avoiding unnecessary risks from the opposite sex
By avoiding unhygienic sex practices.
Extra care before blood test etc

CARBON (EMISSIONS) TRADING

Carbon emissions trading is a form of carbon dioxide emissions trading (calculated in tones of carbon dioxide equivalent or tCO2e). This trading is a common method in developed countries as specified by the Kyoto Protocol for the reduction of carbon emissions for future climate change.

Carbon emissions trading works by setting a quantitative limit on the emissions produced by emitters. In the case of climate change, GHG emissions affect the welfare of people living in the future, as well as affecting the natural environment and external costs (ethical issues, social issues, services) may affect the welfare of people.

Carbon emissions trading has been steadily increasing in recent years. According to the World Bank's Carbon Finance Unit, 374 million metric tones of carbon dioxide equivalent (tCO2e) were exchanged through projects in 2005, a 240% increase relative to 2004 (110 mtCO2e) which was itself a 41% increase relative to 2003 (78 mtCO2e).

Based on a survey of 12 European countries, it was concluded that an increase in carbon and fuel prices of approximately ten percent would result in a short-run increase in electrical power prices of roughly eight percent.[28] This would suggest that lowering carbon emissions will likely lead to an increase in the costs of alternative power sources.

One criticism of carbon trading is that it is a form of colonialism, where rich countries maintain their levels of consumption while getting credit for carbon savings in

inefficient industrial projects. Nations that have fewer financial resources may find that they cannot afford the permits necessary for developing an industrial infrastructure, thus inhibiting these countries economic development.
Another criticism is of non-existent emission reductions produced in the Kyoto Protocol due to the surplus ("hot air") of allowances that some countries have.

CYBERNETICS

Cybernetics is the interdisciplinary study of the structure of regulatory systems. Cybernetics is closely related to information theory, control theory and systems theory.
The term *cybernetics* is a broad field of study, but the essential goal of cybernetics is to understand and define the functions and processes of systems that have goals and that move from action to the desired goal, and again to action in circular or chain systems. Studies in cybernetics provide a means for examining the design and function of any system, including social systems such as business management and organizational learning more efficient and effective.
Cybernetics is most applicable when the system is being analyzed in a closed signal loop ie., where action by the system causes some change in its environment and that change is fed to the system via information. The system changes affect its behavior. This "circular casual" relationship is necessary and sufficient for a cybernetic perspective.
The early 20th century: Contemporary cybernetics began as an interdisciplinary study connecting the fields of control systems, electrical network theory, mechanical engineering, logic modeling, evolutionary biology and neuroscience in the 1940s. Recent endeavors into the true focus of cybernetics, systems of control and emergent behavior, by such related fields as game theory (the analysis of group interaction), systems of feedback in evolution, and meta materials (the study of materials with properties have led to a revived interest in this increasingly relevant field.

15. ADDITIONAL TOPICS

1. Alpha Diversity and Beta Diversity

The term **alpha diversity** (α-diversity) was introduced by R. H. Whittaker[1][2] together with the terms beta diversity (β-diversity) and gamma diversity (γ-diversity). Whittaker's idea was that the total species diversity in a landscape (gamma diversity) is determined by two different things, the mean species diversity in sites or habitats at a more local scale (alpha diversity) and the differentiation among those habitats.

Both the area or landscape of interest and the sites or habitats within it may be of very different sizes in different situations, and no consensus has been reached on what spatial scales are appropriate to quantify alpha diversity.[3] It has therefore been proposed that the definition of alpha diversity does not need to be tied to a specific spatial scale: alpha diversity can be measured for an existing dataset that consists of subunits at any scale.[4] The subunits can be, for example, sampling units that were already used in the field when carrying out the inventory, or grid cells that are delimited just for the purpose of analysis. If results are extrapolated beyond

the actual observations, it needs to be taken into account that the species diversity in the subunits generally gives an underestimation of the species diversity in larger areas.

The term **beta diversity** (β-diversity) was introduced by R. H. Whittaker[1] together with the terms alpha diversity (α-diversity) andgamma diversity (γ-diversity). The idea was that the total species diversity in a landscape (γ) is determined by two different things, the mean species diversity at the habitat level (α) and the differentiation among habitats (β). Whittaker proposed several ways of quantifying differentiation, and subsequent generations of ecologists have invented more. As a result, the definition of beta diversity has become quite contentious.[2][3] Some use beta diversity as a broad umbrella term that can refer to any of several indices related to compositional heterogeneity.[4][5][6] Others argue that such broad usage should be avoided because it leads to confusion. Instead, they propose that the term beta diversity be used to refer to one phenomenon only (true beta diversity), and that other things be referred to by other names.

Beta diversity in the strict sense (True beta diversity)[edit source | editbeta]

Gamma diversity and alpha diversity can be calculated directly from species inventory data.[2][11] The simplest of Whittaker's original definitions of beta diversity is

$\beta = \gamma/\alpha$

Here gamma diversity is the total species diversity of a landscape, and alpha diversity is the mean species diversity per habitat. Because the limits among habitats and landscapes are diffuse and to some degree subjective, it has been proposed that gamma diversity can be quantified for any inventory dataset, and that alpha and beta diversity can be quantified whenever the dataset is divided into subunits. Then gamma diversity is the total species diversity in the dataset and alpha diversity the mean species diversity per subunit. Beta diversity quantifies how many subunits there would be if the total species diversity of the dataset and the mean species diversity per subunit remained the same, but the subunits shared no species.

2.Remote Sensing

Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object. In modern usage, the term generally refers to the use of aerial sensor technologies to detect and classify objects on Earth (both on the surface, and in theatmosphere and oceans) by means of propagated signals (e.g. electromagnetic radiation emitted from aircraft or satellites)

Applications of remote sensing data

- Conventional radar is mostly associated with aerial traffic control, early warning, and certain large scale meteorological data. Doppler radar is used by local law enforcements' monitoring of speed limits and in enhanced meteorological collection such as wind speed and direction within weather systems. Other types of active collection includes plasmas in the ionosphere. Interferometric synthetic aperture radar is used to produce precise digital elevation models of large scale terrain (See RADARSAT, TerraSAR-X, Magellan).
- Laser and radar altimeters on satellites have provided a wide range of data. By measuring the bulges of water caused by gravity, they map features on the seafloor to a resolution of a mile or so. By measuring the height and wavelength of ocean waves, the altimeters measure wind speeds and direction, and surface ocean currents and directions.

- Light detection and ranging (LIDAR) is well known in examples of weapon ranging, laser illuminated homing of projectiles. LIDAR is used to detect and measure the concentration of various chemicals in the atmosphere, while airborne LIDAR can be used to measure heights of objects and features on the ground more accurately than with radar technology. Vegetation remote sensing is a principal application of LIDAR.
- Radiometers and photometers are the most common instrument in use, collecting reflected and emitted radiation in a wide range of frequencies. The most common are visible and infrared sensors, followed by microwave, gamma ray and rarely, ultraviolet. They may also be used to detect the emission spectra of various chemicals, providing data on chemical concentrations in the atmosphere.
- Stereographic pairs of aerial photographs have often been used to make topographic maps by imagery and terrain analysts in trafficability and highway departments for potential routes.
- Simultaneous multi-spectral platforms such as Landsat have been in use since the 70's. These thematic mappers take images in multiple wavelengths of electro-magnetic radiation (multi-spectral) and are usually found on Earth observation satellites, including (for example) the Landsat program or the IKONOS satellite. Maps of land cover and land use from thematic mapping can be used to prospect for minerals, detect or monitor land usage, deforestation, and examine the health of indigenous plants and crops, including entire farming regions or forests.
- Hyperspectral imaging produces an image where each pixel has full spectral information with imaging narrow spectral bands over a contiguous spectral range. Hyperspectral imagers are used in various applications including mineralogy, biology, defence, and environmental measurements.
- Within the scope of the combat against desertification, remote sensing allows to follow-up and monitor risk areas in the long term, to determine desertification factors, to support decision-makers in defining relevant measures of environmental management, and to assess their impacts.

3.GIS

A **geographic information system** (**GIS**) is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data. The acronym *GIS* is sometimes used for **geographical information science** or **geospatial information studies** to refer to the academic discipline or career of working with geographic information systems and is a large domain within the broader academic discipline of Geoinformatics.[1] In the simplest terms, GIS is the merging of cartography, statistical analysis, andcomputer science technology.

A GIS can be thought of as a system—it digitally creates and "manipulates" spatial areas that may be jurisdictional, purpose, or application-oriented. Generally, a GIS is custom-designed for an organization. Hence, a GIS developed for an application, jurisdiction, enterprise, or purpose may not be necessarily interoperable or compatible with a GIS that has been developed for some other application, jurisdiction, enterprise, or purpose. What goes beyond a GIS is a spatial data infrastructure, a concept that has no such restrictive boundaries.

In a general sense, the term describes any information system that integrates, stores, edits, analyzes, shares, and displays geographicinformation for informing decision making. GIS applications are tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data in maps, and present the results of all these operations.[2] Geographic information science is the science underlying geographic concepts, applications, and systems.[3]

The first known use of the term "Geographic Information System" was by Roger Tomlinson in the year 1968 in his paper "A Geographic Information System for Regional Planning".[4] Tomlinson is also acknowledged as the "father of GIS".

Applications

GIS is a relatively broad term that can refer to a number of different technologies, processes, and methods. It is attached to many operations and has many applications related to engineering, planning, management, transport/logistics, insurance, telecommunications, and business. For that reason, GIS and location intelligence applications can be the foundation for many location-enabled services that rely on analysis, visualization and dissemination of results for collaborative decision making.

16. University previous Question papers

Code No: A109210301 **R09** **SETNO: 02**

II B.Tech I Semester Examinations, December 2011

ENVIRONMENTAL STUDIES

Common to ME, CHEM, MEP, AE, ETM, ECE

Time:3hours

Max Marks: 75

Answer any FIVE Questions

All Questions carry equal marks

?

1. Give the guidelines for sustainable development? [15]

2. How GIS and remote sensing methods are useful in EIA? [15]

3. What is phosphorus cycle with diagram? [15]

4. Can companies and government department be also prosecuted under the air act? [15]

5. Explain the importance of biodiversity? [15]

6. Explain that changes likely to occur in annual temperature and precipitation as a result of global warming? [15]

7. Explain about ecologically sound, economically viable engineering alternatives to large dams? [15]

8. Write the impacts of fertilizers on soil? [15]

Code No: A109210301 **R09** **SETNO:04**

II B.Tech I Semester Examinations, December 2011

ENVIRONMENTAL STUDIES

Common to ME, CHEM, MEP, AE, ETM, ECE

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

1. Write about biomedical waste management and handling rules? [15]

2. Explain about draft and _nal environmental impact statements? [15]

3. Explain about hydrological cycle, with diagram? [15]

4. Explain about productive use of biodiversity? [15]

5. Explain about pyramid of numbers with examples? [15]

6. Write the concepts of sustainable development? [15]

7. What are the adjustments to be considered for potential global warming? [15]

8. Explain about the collection of municipal solid waste? [15]

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Code No: A109210301 **R09** **Set No. 1**

II B.Tech I Semester Examinations, December 2011

ENVIRONMENTAL STUDIES

Common to ME, CHEM, MEP, AE, ETM, ECE

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

?

1. What is green house effect? [15]

2. Explain the living and non-living natural resources? [15]

3. Explain about the in-situ conservation of biodiversity? [15]

4. (a) How is environment defined under Indian law?

(b) What is the reason that every person should know the law? [15]

5. Explain about salient features of matrices methods for carrying out EIA? [15]

6. How crazy consumerism can overcome exploitation of resources? [15]

7. Write about the E-waste management? [15]

8. What is biosphere? [15]

Code No: A109210301 **R09** **Set No. 3**

II B.Tech I Semester Examinations, December 2011

ENVIRONMENTAL STUDIES

Common to ME, CHEM, MEP, AE, ETM, ECE

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

1. Write about the pollutants? [15]

2. Write about subsurface mining? [15]

3. How to carry out the impact assessment study on vegetation and wild life? [15]

4. Write different types of ecosystems with diagrams? [15]

5. What are the threats to sustainability? [15]

6. Explain about the aesthetic value of biodiversity? [15]

7. What are the current requirement that should be met before declaring an area in

to a wide life sanctuary or a national park under the forest acts? [15]

8. How human activity has resulted in increased emissions of green house gases? [15]

UNIT WISE QUESTION BANK

Unit 1

1. Explain about potassium cycle with diagram?

2. What is an ecosystem? Describe the structure and function of various components of an ecosystem?

3. What is environment? Explain various components of environment.

4. What are ecological pyramids? Draw ecological pyramids for Pond and Desert ecosystem?

5. Discuss the typical features of an estuarine ecosystem.

6. Write about the structure and function of Pond ecosystem, forest ecosystem and aquatic ecosystems.

7. Write briefly about the energy flow in an ecosystem.

8. Discuss about Ecological succession.

9. Define the terms (a)Biomagnification (b) bioaccumulation (c) Homeostasis and Cybernatics (d) Carrying capacity.

10. Write a short note on producers , consumers and decomposers.

UNIT 2

1.Explain about soil degradation?

2. Explain Renewable and Non renewable energy resources with examples?

3. State the environmental effects of extracting and using mineral resources? State the need for public awareness for solving environmental problems.

4. Compare Nuclear energy with coal? Write a note on energy conservation?

5. What is solar space heating? Explain solution.

6. Write briefly about any four alternative sources of energy? Compare their cost effectiveness.

7. What are benefits of Dams? Explain environmental impacts of Dams.

8. Define mining? Explain environmental impacts on mining extraction?

9. Write the effects of extracting mineral resources.

10. What are the effects of modern agriculture on environment?

11.Discuss the causes for Land degradation.

12. Explain briefly about Land use and land cover mapping?

13.Explain briefly about water resources.

UNIT 3

1. What will happen to biodiversity if the grizzly bear becomes extinct?

2. Explain various threats to biodiversity?

3. Discuss the causes for man wildlife conflits. Suggest suitable wild life conservation practices.

4. Explain the values of Biodiversity.

5. What is Biodiversity? Explain different types of Biodiversity with examples.

6.Explain insitu and exsitu conservation of biodiversity with examples.

7. Write a short note on Hotspots of Biodiversity.

8. Explain Poaching of wild life and Biogeographical classification of India.

9. What are different endangered and endemic species present in Red data book?

10. Explain breify about Food and fodder resources.

11. What are Timber and Non timber products of Forests?

UNIT 4

1.Write about different causes for coastal pollution?

2. Discuss major Air pollutants and their impacts?

3. Explain various methods of controlling Air pollution?

4.Explain the effects of Nuclear and Radiation pollution.

5. What are the sources of marine pollution? Explain its control measures.

6. What is Thermal pollution?Explain its impacts in Stream water Quality

7. What is Noise pollution and list out the possible impacts of Noise pollution on human health.

8. Explain the causes, effects and control measures of water pollution?

9. Explain Nuclear accidents and holocausts.

10. What is a solid waste and what arte its disposal techniques?

11. Write about E-waste?

12. Describe different methods involved in waste water treatment technology?

13. What is Soil pollution and what are the effects of soil pollution on Agriculture?

UNIT 4

1.Explain about the climate change and its causes?

2. What steps can be taken to reduce the acidity of oceans due to dissolving of carbon deposits near the north pole?

3. What is Acid rain? Explain its impact on health, land and water bodies

What is enhanced global warming? Explain its causes and effects on human health and natural resources.

4. What are the causes for soil erosion and deforestation? Explain in detail.

5.Discuss the consequences of over drawing surface and ground water.

6. Explain Global warming and its preventive measures.

7. Explain the reaction involved in Ozone layer Depletion and various Ozone depleting substances.

8.Explain various effects and control measures of Ozone layer depletion?

9.Give an account of the International protocol held which discussed about Ozone layer Depletion.

10.Give an account of Montreal and Kyoto Protocol.

11.What is Deforestation? Give the effects, causes of deforestation.

12.What is meant by desertification and its effects?

UNIT 5

1. What is Environmental Impact assessment?

2. What are the positive and negative impacts?

3. Describe the reversible and irreversible impacts.

4. What is Environmental Management Plan?

5. Explain Green belt technologies.

6. What is the role of remote sensing in EIA?

7.Explain about Draft and final environmental impact statements?

UNIT 5

1.What are the requirements that are fulfilled under the E.P.A ?

2. Explain salient features of EPA act.

3. Explain the typical features of Water Act.

4. Discuss briefly about the disposal of Municipal solid waste management?

5.Explain forest conservation Act.

6. What are different categories of biomedical waste Management Rules.

7. What are Hazardous waste and explain the Hazardous waste management rules.

UNIT 5

1.Explain the phenomenon of Salt water intrusion.

2. explain the role of individual in conservation of Natural resources?

3. Discuss about family welfare program?

4. Write briefly the role of IT in environment and human health?

5. What is environment education? Explain its objectives and activities.

6. What is the concept of Sustainable Development? What are the practices to transfer unsustainablity towards sustainability?

7. Explain the impact of human population on environment.

8. Explain about the importance of value education.

9. Explain the concept of Green building technology

17. Question Bank

UNIT WISE QUESTIONS

UNIT 1

1. Explain about potassium cycle with diagram?

2. What is an ecosystem? Describe the structure and function of various components of an ecosystem?

3. What is environment? Explain various components of environment.

4. What are ecological pyramids? Draw ecological pyramids for Pond and Desert ecosystem?

5. Discuss the typical features of an estuarine ecosystem.

UNIT 2

1.Explain about soil degradation?

2. Explain Renewable and Non renewable energy resources with examples?

3. State the environmental effects of extracting and using mineral resources? State the need for public awareness for solving environmental problems.

4. Compare Nuclear energy with coal? Write a note on energy conservation?

5. What is solar space heating? Explain solution.

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18. Assignment topics

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19.Unit-wise quiz question

UNIT WISE BITS WITH KEY

UNIT -1

1. Air pollution control act in India was passed in the year _ _ _ _ _ _ _ _

2. _ _ _ _ _ _ _ _ was poisonous gas responsible for Bhopal disaster.

3. _ _ _ _ _ _ _ _ gas is responsible for Bhopal tragedy.

4. Bhopal gas disaster took place in the year _ _ _ _ _ _ _

5. The atmosphere normally contains _ _ _ _ _ _ % of oxygen.

6. _ _ _ _ _ _ _ _ _ _ gas is present in high percentage in air.

7. The inner most layer of atmosphere is

8. _ _ _ _ _ _ _ _ _ is the second layer of the atmosphere.

9. _ _ _ _ _ _ _ _ is primary pollutant

10. _ _ _ _ _ _ _ _ is primary pollutant

11. _ _ _ _ _ _ _ _ _ _ _ _ is primary pollutant.

a. NO 2

b. HNO 3

c. PAN

d. HCl

12. _ _ _ _ _ _ _ _ _ _ _ is a secondary pollutant.

a. CO

b. CO 2

c. H2SO4.

d. SO 3

13. _ _ _ _ _ _ _ _ _ _ _ is a secondary pollutant.

a. CO

b. H2SO4

c. O 2

d. NO 2

14. In the following _ _ _ _ _ _ _ _ _ _ acts as secondary pollutant.

a. Cl_2

b. Br_2

c. HNO 3

d. NO 2

15. _ _ _ _ _ _ _ is an example for aerosol.

a. CO_2 in air

b. Dust storm

c. O_3 in air

d. SO_2 in air

16. _ _ _ _ _ _ _ is an example for aerosol

a. in rain

b. SO_3 in air

c. Cigarette smoke

d. O_2 in air2

17. In the following example for aerosol is

a. Fog

b. Acid rain

c. Chloro carbons

d. Argon in air

18. _ _ _ _ _ _ _ gas acts as screen for UV radiation in the upper atmosphere.

a. CO 2

b. O 2

c. O 3

d. SO 3

19. _ _ _ _ _ _ _ _ _ _ _ gas acts as protective screen against harmful radiation in the upper atmosphere.

a. O 2

b. Cl2

c. Argon gas

d. O 3

20. The thickness of the ozone layer is measured _ _ _ _ _ _ in units.

a. Dalton

b. Derby

c. Dobson

d. Deci

KEY: 1. 1981;

2. CH3CNO;

3. Methyl isocyanide;

4. 1984;

5.20;

6. Nitrogen;

7. Troposphere;

8. Stratosphere;

9. CO_2 10.SO_2;

11.a;

12.C;

13.b;

14.c;

15.b

16.c;

17.a

18.c;

19.d;

20.c.

UNIT 2

1. _ _ _ _ _ _ _ _ are responsible for ozone depletion.

2. _ _ _ _ _ _ _ _ is the fourth most polluted city in the world, according to WHO.

3. Environmental Protection Act (EPA) was passed in the year _ _ _ _ _ _ in India.

4. According to the Central Pollution Control Board (CPCB) _ _ _ _ _ _ _ _ city is highly particulated air polluted.

5. _ _ _ _ _ _ _ _ _ _ can acts as primary pollutant.

6. In the following _ _ _ _ _ _ _ acts as aerosol.

7. _ _ _ _ _ _ _ _ _ is present in vehicular exhaust

8. _ _ _ _ _ _ _ _ is single largest source for carbon monoxide

9. Carbon monoxide effects _ _ _ in humans.

10. National Environmental Engineering Research Institute (NEERI) is situated at

11. _ _ _ _ _ _ _ _ % of earth surface is covered by water.

a.80

b. 60

c. 71

d. 85

12. _ _ _ _ _ _ _ _ _ % of water is in the form of available water in total volume of water on earth.

a. 3

b. 0.03

c. 0.3

d. 0.003

13. Porous water saturated layer of sand through which water flows is called

a. aqua sol

b. aqua region

c. aquifers

d. aqua gel

14. BOD means

a. Biochemical Ozone Demand

b. Biological Oxygen Demand

c. Bacterial Oxygen Demand

d. Biosphere Oxygen Demand

15. The excessive growth of algae and aquatic plants due to the added nutrients in water is called as _ _ _ _ _ _ _ _ _ _

a. magnification

b. implication

c. accumulation

d. eutrophication

16. Contamination of water by fertilizers in ponds can leads to

a. Implication

b. Magnification

c. Accumulation

d. Eutrophication

17. _ _ _ _ _ _ _ is one of the worst oil spill disaster.

a. Chernobyl

b. Exxon Valdez

c. Chipko

d. Alaska

18. Pyrite oxidation thesis on ground water pollution mainly describes about _ _ _ _ _ _ _ poisoning of ground water.

a. mercury

b. arsenic

c. copper

d. aluminum

19. Under ideal conditions, soft parent material may develop into 1 cm of soil with in _ _ _ _ _ years.

a. 15

b. 10

c. 5

d. 20

20. The top or little surface of the soil is called as _ _ _ _ _ _ _ _ _ _ _

a. O-horizon

b. A-horizon

c. B-horizon

d. C-horizon

KEY: 1.Chloroflourocarbons;

2. Delhi;

3.1986;

4. Ahmedabad;

5. CO

6. HNO_3 in acid rain;

7.CO;

8. Vehicular exhaust;

9. Blood;

10.Nagpur;

11.c;

12.d

13.C;

14.b;

15.d;

16. D;

17.b;

18.b;

19.a;

20.a

UNIT 3

1. In _ _ _ _ _ _ _ _ _ part of the soil humus is present.

2. The chemical composition of the soil is determined by _ _ _ _ _ _ _ _ part of the soil.

3. _ _ _ _ _ _ part of the soil does not contain any organic material.

4. Soil with equal mixture of clay, sand. Silt and humus is called

5. The rate of absorption and retention of water is determined by _ _ _ _ _ _ _ _ part of the soil.

6. _ _ _ _ _ _ _ _ _ _ is the macronutrient of the soil.

7. _ _ _ _ _ _ _ _ _ is the micronutrient of the soil.

8. _ _ _ _ _ _ _ _ is the micronutrient for the soil.

9. Herbicides are used to control _ _ _ _ _ _ _ _ _ growth.

10. Noise is measured in _ _ _ _ _ _ _ _ _ _ units.

11. The permitted level of noise according to environmental protection rules is

a. 125 decibels

b. 200 decibels

c. 150 decibels

d. 500 decibels

12. _ _ _ _ _ _ _ _ _ is the first country which developed the atomic bomb.

a. Russia

b. Japan

c. Germany

d. America

13. Approximately _ _ _ _ _ _ _ _ _ % of electrical energy is coming from atomic power plants.

a. 10

b. 50

c. 30

d. 17

14. Chernobyl disaster took place in _ _ _ _ _ _ _ _ _ _ year.

a. 1986

b. 1987

c. 1985

d. 1984

15. Over exposure to radiation may lead to

a. TB

b. Mutations

c. AIDS

d. Diarrhea

16. Activated sludge process which is used in the water treatment mainly gives _ _ _ _ _ _ _ _ as by product

a. H 2S

b. Cl

c. CO 2

d. O 2

17. Activated sludge process which is used in the water treatment mainly gives _ _ _ _ _ _ _ _ as by product

a. Cl

2

b. CO 2

c. CH 4

d. H 2S

18. _ _ _ _ _ _ _ _ _ _ _ disaster is occurred due to mercury poisoning.

a. Bhopal

b. Minimata

c. Chernobyl

d. Exxon Valdez

19. Minimata disaster took place in

a. Japan

b. India

c. America

d. China

20. Excessive extraction of ground water may leads to _ _ _ _ _ _ _ _

a. Chlorosis

b. Necrosis

c. Fluorosis

d. Arsenosis

KEY:

1. A-horizon;

2. C- horizon;

3.C-horizon;

4. Loams;

5. B- Horizon

6. Nitrogen

7.Zinc

8. Boron

9.Algae;

10. Decibel;

11.a

12. a;

13.d;

14.a;

15.b;

16.c;

17.c

18.b

19.a;

20.c.

UNIT 4

1. Fluorosis may leads to damage of _ _ _ _ _ _ _ _ _ in humans.

2. _ _ _ _ _ _ _ _ is the pesticide residue, which was found in the bottled water used for drinking purposes

3. India has a coastal line of _ _ _ _ _ _ _ km

4. "Tsunami" word came from _ _ _ _ _ _ language.

5. Worst disaster of tsunami occurred in _ _ _ _ _ _ _ _ year.

6. _ _ _ _ _ _ _ _ _ _ _ _ _ % of rain water can be stored in dams of India.

7. The Worst disaster of earth quake occurred in _ _ _ _ _ _ year in India.

8. The Worst disaster of earth quake occurred in _ _ _ _ _ _ part of the India.

9. _ _ _ _ _ _ _ _ _ is considered to be the most destructive natural hazard.

10. The permissible level of oil in drinking water is _ _ _ _ _ _ .

11. To make one ton of paper approximately _ _ _ _ _ _ _ _ number of trees are used.

a. 10

b. 5

c. 17

d. 12

12. Incineration of solid waste is done at _ _ _ _ _ _ _ _ C o

a. 600

b. 815

c. 1000

d. 1200

13. Dead and dry leaves are finally converted into _ _ _ _ _ _ _ _ by fungi and bacteria.

a. humus

b. compost

c. loam

d. colon

14. Lead pollution is mainly due to _ _ _ _ _ _ _ _ _ _

a. power plants

b. oil spills

c. vehicular exhausts

d. coal firing

15. Anaerobic bacteria decompose organic matter into _ _ _ _ _ _ _

a. O_2

b. CO

c. CH_4

d. H_2O

16. Aerobic bacteria decompose organic material into _ _ _ _ _ _ _

a. CO_2

b. CO

c. CH_4

d. H_2S

17. Anaerobic bacteria decompose organic matter into _ _ _ _ _ _ _

a. CO_2

b. CO

c. H_2S

d. SO_2

18. Treatment of waster water with bacteria is called as _ _ _ _ _ _ _ _ _ process.

a. sedimentation

b. trickling filter

c. activated sludge

d. coagulation

19. Treatment of drinking water with bleaching powder is called as _ _ _ _ _ _

a. coagulation

b. sedimentation

c. separation

d. sterilization

20. Thermal pollution of water can lead to

a. Decreases in the solubility of O2 2

b. Increases in the solubility of O 2

c. Decreases in the solubility of CO

d. Decreases in the metabolism of fish

Key:

1. Bones;

2. Chloropyrifas;

3.5700;

4. Japanese;

5. 2005;

6. 55;

7.2001;

8.Gujarat;

9.Earth quake

10.0.01mg/l ;

11.c;

12.b;

13.b;

14.c;

15.c;

16.a;

17.c;

18.c;

19.d;

20.a

UNIT 4

1. _ _ _ _ _ _ _ _ _ are used to examine the bone fractures

2. _ _ _ _ _ _ _ _ is used in the nuclear power plants for fission purposes.

3. Pani Panchayat was initiated by

4. _ _ _ _ _ _ _ _ _ _ _ _ movement was initiated by Vilasarao Salunke

5. Water saving in agriculture can be done by

6. Tehri project construction is occurring in the state of

7. Chipko Movement is against

8. _ _ _ _ _ _ _ _ year is the warmest year, according to the Environmental Protection Agency.

9. Chipko movement was stated by

10. Sunderlal Bahuguna initiated movement it is called as _ _ _ _ _ _ _ _ movement

11. Presence of _ _ _ _ _ _ _ _ _ _ _ _ _ in atmosphere is mainly responsible for acid rain.

a. CO 2

b. CO

c. SO 3

d. O 3

12. Presence of _ _ _ _ _ _ _ _ _ _ _ _ _ _ in atmosphere is mainly responsible for acid rain.

a. CO 2

b. CO

c. SO 3

d. O 3

13. Presence of _ _ _ _ _ _ _ _ _ _ _ _ _ _ in atmosphere is mainly responsible for acid rain.

a. CO 2

b. Ar

c. NO 2

d. O 31

14. WHO means

a. World Happier Organization

b. World Health Organization

c. World Hope Organization

d. World Harvest Organization

15. _ _ _ _ _ _ _ _ _ % of solar energy is absorbed by the earth's surface.

a. 82

b. 58

c. 75

d. 68

16. _ _ _ _ _ _ _ _ _ _ gas is responsible for green house effect.

a. O 2

b. CO 2

c. H 2

d. He

17. _ _ _ _ _ _ _ _ _ _ gas is responsible for global warming.

a. O 2

b. CO 2

c. H 2

d. He

18. _ _ _ _ _ _ _ _ _ _ are the gases that cause global warming.

a. CFC

b. DDT

c.chloroform

d.aldrin

19. _ _ _ _ _ _ _ _ _ _ is responsible for global warming.

a. DDT

b. CH 4

c. So2

d. CCl

20. Acid rain will cause _ _ _ _ _ _ _ _

a. global warming

b. green house effect

c. Loss of nutrients from the soil

d. elnino

Key:

1. X-rays

2.Uranium;

3. Vilasrao Salunke;

4. Pani Panchayat;

5.Drip irrigation;

6.Uttar Pradesh

7. Deforestation;

8. 1998;

9.Sunderlal bahuguna;

10. Chipko;

11.c;

12.c;

13.c ;

14.b;

15.c;

16.b;

17.b;

18.a;

19.b;

20.c.

UNIT 5

1. Acid rains may affect _ _ _ _ _ _ _ _ _ _ _ _

2. _ _ _ _ _ _ _ _ _ _ treaty was signed by India for the protection of ozone layer.

3. _ _ _ _ _ _ _ _ _ _ _ _ state in India has banned the use of all types of polyethylene packings.

4. Waste plastic can be converted into _ _ _ _ _ _ _ _ _ _

5. The air (prevention and control of pollution) act was passed in _ _ _ _ _ _ year by Indian Government.

6. The water (prevention and control of pollution) act was passed in _ _ _ _ _ _ year by Indian Government.

7. The wild life protection act was passed in _ _ _ _ _ _ year by Indian Government.

8. The amendment to the wild life protection act was done in _ _ _ _ _ _ year.

9. The Forest conservation act was passed in _ _ _ _ _ _ year by Indian

10. The amendment to the Forest conservation act was done in _ _ _ _ _ _ year

11. Narmada Bachavo Andolan is fighting against

a. Deforestation

b. Water pollution

c. Air pollution

d. Construction of dam

12. March 21st of every year is celebrated as

a. World health day

b. Earth day

c. World population day

d. World forest day

13. March 6th of every year is declared as

a. Hiroshima day

b. Earth day

c. World population day

d. World heritage day

14. June 5th of every year is declared as

a. Population day

b. Earth day

c. Environment day

d. World health day

15. April 22nd is celebrated as

a. Earth day

b. Heritage day

c. Health day

d. Wild life day

16. In 1950, (with 10 million population) _ _ _ _ _ _ _ _ city is considered as only mega city.

a. London

b. Paris

c. Egypt

d. New York

17. _ _ _ _ _ _ _ _ fever will result due to the biting of Anopheles mosquito.

a. Yellow

b. Dengue

c. Chicken Gunya

d. Malaria

18. Diarrhea will result due to _ _ _ _ _ _ _ _ _ _ pollution.

a. water

b. noise

c. air

d. radioactive

19. Malaria fever results due to

a. Un hygienic food

b. Mosquito bite

c. Radio active pollution

d. Contamination of water by lead

20. Earth day is celebrated on

a. April 22nd

b. March 5th

c. May 1st

d. June 2nd

Key:

1. Corrosion of metal parts;

2.Montreal;

3.Himachal Pradesh;

4.LPG;

5.1982;

6.1974;

7.1972;

8.2002;

9.1980;

10.1988

11.d;

12.d;

13.a

14.c;

15.a;

16.d;

17.d;

18.a

19.b;

20.a.

UNIT- 5

1. Diahhrea can be prevented by taking _ _ _ _ _ _ _ _ step
2. World environment day is celebrated on
3. World ozone day is on _ _ _ _ _ _ every year.
4. World forest day is on _ _ _ _ _ _ _ _ _ _ every year.
5. World population day is on _ _ _ _ _ _ _ every year.
6. World health day is celebrated on _ _ _ _ _ _ _ _ _ _
7. Hiroshima day is marked _ _ _ _ _ _ _ _ _ _ on every year.
8. World heritage day is _ _ _ _ _ _ _ _ _ _ on every year.
9. Listeria monocytogens (Lm) spreads due to _ _ _ _ _ _ _ _ _ _ _ _ _ _ in humans.
10. Cancer is……..
11. Cancer can be treated by using

a. IR radiation

b. UV radiation

c. X-rays

d. ß-rays

12. X- rays are used for the treatment of

a. Cancer

b. AIDS

c. Malaria

d. TB

13. Carcinogens means

a. Water spread disease

b. Cancer causing agent

c. Type of UV rays

d. Disease caused by bacteria

14. I.P.R means

a. Indian Penal Regulation

b. Indian Protection Right

c. Intellectual Property Right

d. Indian Police Right

15. Leukemia is a _ _ _ _ _ _ _ _ _ _

a. Type of bacteria

b. Type of virus

c. Blood cancer

d. Type of fungi

16. HIV means

a. Human Invitro Virus

b. Human Interstitial Virus

c. Human Immuno Deficiency Virus

d. Human Intestine Virus

17. HIV is a

a. Virus

b. Fungi

c. Bacteria

d. Protozoa

18. AIDS is caused by

a. Fungi

b. Bacteria

c. Virus

d. Protozoa

19. AIDS means

a. Acquired Immuno Deficiency Symptom

b. Acquired Immuno Decreasing Symptom

c. Acquired Immuno Deficiency Syndrome

d. Acquired Immuno Delaying Virus

20. In 2002, India is estimated to have approximately _ _ _ _ _ _ _ _ number of infected AIDS patients.

a. 4 million

b. 10 million

c. 50 million

d. 1 million

Key:

1. Safe drinking water;

2. June 5;

3.Sep 16t;h

4. March 21;

5. June 11;

6. April 7;

7. Aug 6th;

8.April 18;

9.contaminated food;

10.Uncontrolled growth of cells in the body.

11.c;

12.a;

13.b

14.c;

15.c;

16.c;

17.a;

18.c;

19.c

20.a

UNIT- 5

1. _ _ _ _ _ _ _ _ _ _ is the third largest cause of diseases and death in India.

2. Pneumonia affects _ _ _ _ _ _ _ _ _ _ system in humans.

3. GIS means

4. The revolutionary GIS scheme of Karnataka is called

5. According to the global survey, the population of world is approximately _ _ _ _

_ _ _ billion.

6. Global warming can lead to

7. Rise in sea levels is mainly due to _ _ _ _ _ _ _ _ _ _ _

8. Tuberculosis is caused by _ _ _ _ _ _ _ _ _ _ _ _ _

9. Harmful UV radiation can cause

10. Amoebiasis is caused by _ _ _ _ _ _ _ _ _ _ _ organisms.

a. viruses

b. fungi

c. protozoa

d. bacteria

11. SARS means

a. Severe Acute Respiratory Syndrome

b. Severe Acute Renal Syndrome

c. Serious Acute Respiratory Syndrome

d. Severe Alternation of rain fall in states

12. SARS is caused by

a. Virus

b. Bacteria

c. Protozoa

d. Fungi

13. SARS affects _ _ _ _ _ _ _ _ _ system in humans.

a. Digestive

b. Excretory

c. Circulatory

d. Respiratory

14. _ _ _ _ _ _ _ _ _ _ _ is malarial parasite

a. E.Coli

b. Retro virus

c. Mycobacterium

d. Plasmodium Vivax

15. Plasmodium parasite _ _ _ _ _ _ _ _ _ causes in humans.

a. Dysentery

b. TB

c. AIDS

d. Malaria

16. _ _ _ _ _ _ _ _ _ _ _ _ is a water borne disease.

a. Typhoid

b. TB

c. Malaria

d. AIDS

17. Round warm effects _ _ _ of children.

a. liver

b. lungs

c. intestine

d. ears

18. _ _ _ _ _ _ _ _ _ article in the constitution of India tells about protection and improvement of wild life and forest in the country.

a. 40 A

b. 48 A

c. 60 A

d. 80 A

19. A article of Indian constitution tells about

a. Protection of children and women

b. Protection of monuments

c. Protection of rivers and lakes

d. Protection of wildlife and forests

20. In 1981-82 in some parts of Punjab, wheat crops are turned white, which is due to the presence of _ _ _ _ _ _ _ _ _ _ _ _ in the soil

a. iron

b. arsenic

c. selenium

d. copper

KEY:

1. Chula smoke;

2. Respiratory;

3. Geological Information system

4.Bhoomi;

5.6;

6.Rise in sea levels;

7.Global warming;

8. Bacteria;

9. Skin cancer

10. Protozoa

11.a

12.a;

13.d;

14.d;

15.d;

16.a;

17.c;

18.b;

19.d;

20.c

20. Tutorial Problems:

TUTORIAL-I

1. Explain about potassium cycle with diagram?

2. What is an ecosystem? Describe the structure and function of various components of an ecosystem?

3. Define the terms (a)Biomagnification (b) bioaccumulation (c) Homeostasis and Cybernatics (d) Carrying capacity.

4. Write about the structure and function of Pond ecosystem, forest ecosystem and aquatic ecosystems.

TUTORIAL-II

1. Explain Renewable and Non renewable energy resources with examples?

2. State the environmental effects of extracting and using mineral resources? State the need for public awareness for solving environmental problems.

3. Compare Nuclear energy with coal? Write a note on energy conservation?

4. Write briefly about any four alternative sources of energy? Compare their cost effectiveness.

5. What are benefits of Dams? Explain environmental impacts

TUTORIAL-III

1. What will happen to biodiversity if the grizzly bear becomes extinct?

2. Discuss the causes for man wildlife conflits. Suggest suitable wild life conservation practices.

3.Explain insitu and exsitu conservation of biodiversity with examples.

4. Explain breify about Food and fodder resources.

5. Write a short note on Hotspots of Biodiversity.

TUTORIAL-IV

1. Explain various methods of controlling Air pollution?

2. What is Thermal pollution?Explain its impacts in Stream water Quality

3. Describe different methods involved in waste water treatment technology?

What is Noise pollution and list out the possible impacts of Noise pollution on human health.

4. Explain the causes, effects and control measures of water pollution?

TUTORIAL-V

1. What are the positive and negative impacts?

2. Describe the reversible and irreversible impacts.

3. Explain salient features of EPA act.

4. Explain the typical features of Water Act.

5. Discuss about family welfare program?

6. Write briefly the role of IT in environment and human health?

7. Explain the concept of Green building technology

20. Known Curriculum Gaps and inclusion of the same in the lecture schedule:

1. Rare species of different living things
2. General structure of nature

22. Group discussion topics

1. Pollutions

23. References, Journals, websites and E-links

REFERENCES:

1. Textbook of Environmental Sciences and Technology by M. Anji Reddy, BS Publica

2. Environmental Studies by Anubha Kaushik C.P. Kaushik

RELATED JOURNALS

- The **Journal of Environmental Sciences** is an international journal started in 1989 and sponsored by the Research Center for Eco-Environmental Sciences, the Chinese Academy of Sciences.

- ***Ecology and Society*** (formerly *Conservation Ecology*) is a quarterly open access interdisciplinary scientific journal published by the Resilience Alliance.

- ***Environment & Urbanization*** is a biannual peer-reviewed academic journal covering urban studies. It is published by Sage Publications and was established in 1989.

24. Quality Control Sheets

A. Course End Survey:

Course end survey will be collected at the end of the semester.

B. Teaching Evaluation

Quality control department conducts online feedback, two times in the semester.

25. Students list

SlNo	AdmnNo	StudentName
Class / Section: CSE 22A		
1	13R11A05G3	SRIKANTH AKKANAPALLY
2	14R11A0501	AKHILESH G
3	14R11A0502	AKULA KRISHNA
4	14R11A0503	ALLAM USHA SREE
5	14R11A0504	ANANT SRIVATS
6	14R11A0505	AYYAGARI V S V VARDHAMAN
7	14R11A0506	B MOHANA SREYA
8	14R11A0507	B PRASHANTH
9	14R11A0508	BANDA GAYATHRI VEENA
10	14R11A0509	BATTAR SRIKANTH RAGHAVA
11	14R11A0510	BHONSLE SAI KRUTHI
12	14R11A0511	BONAGIRI TEJASHWINI
13	14R11A0512	BOTLA MOUNIKA
14	14R11A0513	D VENKATESH
15	14R11A0514	DASARI PRANAY KUMAR
16	14R11A0515	DEEPIKA TUDIMILA
17	14R11A0516	DOKKA DIVYA
18	14R11A0517	E MADHU BHARGAVA
19	14R11A0518	K JWALA
20	14R11A0519	K SAMHITHA REDDY
21	14R11A0520	K THAPASVI REDDY
22	14R11A0521	KALAKONDA VAISHNAVI
23	14R11A0522	KAMPALLY YAMINI
24	14R11A0523	KONTHAM RAVITEJA REDDY
25	14R11A0524	KOSARAJU LEELA KRISHNA
26	14R11A0525	KRISHNA SWETHA R
27	14R11A0526	KUNDUR ROHAN REDDY
28	14R11A0527	KUNNUMAL MAVILA AMRITHA
29	14R11A0528	KURMA BHARGAV
30	14R11A0529	KUTHURU PRIYANKA
31	14R11A0530	KYASNOORI SHIVANI
32	14R11A0531	M K SREE HARSHA
33	14R11A0532	M POOJA
34	14R11A0533	M SAI KRISHNA
35	14R11A0534	M SHANMUGHA PRIYA
36	14R11A0535	MALLADI RAMYA
37	14R11A0536	MEESALA SHAILAJA
38	14R11A0537	N SRI MANASVI
39	14R11A0538	NADENDLA VENKATA VINEET MURARI
40	14R11A0539	NAKKA AKHIL
41	14R11A0540	NALLANAGULA BHANU PRAKASH
42	14R11A0541	P SOWMYA

43	14R11A0542	PARVATHALA CHETANA
44	14R11A0543	PENDYALA HEMANTH SAI
45	14R11A0544	R CHANDRA MOHAN
46	14R11A0545	REKULA CHANDRAHASA
47	14R11A0546	RUDRARAJU PAVANI
48	14R11A0547	S SWATHI
49	14R11A0548	SAI SINDHU BEERAM
50	14R11A0549	SOPPADANDI AISHWARYA RAJ
51	14R11A0550	SYED VAQUAS ASHRAF
52	14R11A0551	TALLURI MURALI KRISHNA
53	14R11A0552	TAMMEWAR SNEHIT
54	14R11A0553	THIRIVEEDI DHEERAJ KUMAR
55	14R11A0554	THUMMA VINEETHA REDDY
56	14R11A0555	VALLURU VENUMADHURI
57	14R11A0556	VAMANA GUNTLA MANOJ
58	14R11A0557	VENKATA SAITEJA Y
59	14R11A0558	VUSAKA VIKAS REDDY
60	14R11A0559	Y JYOTSNA
Total: 60 Males: 29 Females: 31		
Class / Section: CSE 22B		
1	13R11A0561	BATTU SHIRISH KUMAR REDDY
2	14R11A0560	AKELLA SUBRAMANYA SOUJANYA
3	14R11A0561	ALEENA CHACKO K
4	14R11A0562	BARLA PRAVALIKA
5	14R11A0563	BATHINI DIVYA
6	14R11A0564	BOLLA NAVEEN REDDY
7	14R11A0565	CHAVALI SWATHI
8	14R11A0566	CHEPYALA AKHIL
9	14R11A0567	CHITTARVU LAKSHMI ISHWARYA
10	14R11A0568	DAMAGALLA KARTIK
11	14R11A0569	DHATRI NAIDU BHOGADI
12	14R11A0571	DODDAPANENI SANOJ
13	14R11A0572	DUGGISHETTY SAI PRASANNA
14	14R11A0573	E PAVAN CHANDRA
15	14R11A0574	G BHAVANA
16	14R11A0575	G KISHAN
17	14R11A0576	G LASYA PRIYA
18	14R11A0577	G SIRIVENNELA
19	14R11A0578	GANAPATHI RAJU MADHURI
20	14R11A0579	GANGAVARAPU MANASA
21	14R11A0580	GATTOJI HARITHA
22	14R11A0581	GAYATHRI MANDAL

23	14R11A0582	GORTI SANTOSH KUMAR
24	14R11A0583	HRITIK S
25	14R11A0584	KALYANAM KRUTHIKA REDDY
26	14R11A0585	KANUMURI SRI PRATHYUSHA
27	14R11A0586	KOLLU VINESH BABU
28	14R11A0587	KONDISETTI NIRANJANA KUMARI
29	14R11A0588	KONIKA VENKATA PADMA PRIYA HASINI
30	14R11A0589	KURUP MEGHANA
31	14R11A0590	MADARAJU RAMYA SAI
32	14R11A0591	MEDIPALLY SRIYA
33	14R11A0592	MUDDU DEEPTHI
34	14R11A0593	N LAHARI
35	14R11A0594	N VIKHYAT
36	14R11A0595	NAKEERTHA SANDHYA RANI
37	14R11A0596	NALLAMILLI JYOTHI
38	14R11A0597	NALLAPANENI ADITYA SAI
39	14R11A0598	NAMBURI MANISHA
40	14R11A0599	NIKHIL SINGH P
41	14R11A05A0	ORUGANTI KALPANA
42	14R11A05A1	PATLORI SAI KUMAR
43	14R11A05A2	PEESAPATI VENKATA SAI VAMSI
44	14R11A05A3	PINDIPOLU SRAVYA
45	14R11A05A4	PRANATHI KRISHNA SANGANI
46	14R11A05A5	PUDHOTA AVINASH
47	14R11A05A6	S ASHA LAKSHMI
48	14R11A05A7	S CHANDANA REDDY
49	14R11A05A8	SHAIK HAFEEZ HUSSAIN
50	14R11A05A9	SHEELAM SUSHMA
51	14R11A05B0	SRAVIKA SANKU
52	14R11A05B1	THUMMALA RISHIKA REDDY
53	14R11A05B2	VARSHA CHAHAL
54	14R11A05B3	VEERAVALLI SHILPA
55	14R11A05B4	VUPPUTTURI SUSHANTH KUMAR
56	14R11A05B5	Y ADITHYA
57	14R11A05B6	YEDDU SHASHI KUMAR
58	14R11A05B7	KATAMONI HARSHITHA
59	15R15A0501	B VINESH
60	15R15A0502	B SHRAVAN KUMAR

Class / Section: CSE 22B		
1	13R11A0561	BATTU SHIRISH KUMAR REDDY
2	14R11A0560	AKELLA SUBRAMANYA SOUJANYA

3	14R11A0561	ALEENA CHACKO K
4	14R11A0562	BARLA PRAVALIKA
5	14R11A0563	BATHINI DIVYA
6	14R11A0564	BOLLA NAVEEN REDDY
7	14R11A0565	CHAVALI SWATHI
8	14R11A0566	CHEPYALA AKHIL
9	14R11A0567	CHITTARVU LAKSHMI ISHWARYA
10	14R11A0568	DAMAGALLA KARTIK
11	14R11A0569	DHATRI NAIDU BHOGADI
12	14R11A0571	DODDAPANENI SANOJ
13	14R11A0572	DUGGISHETTY SAI PRASANNA
14	14R11A0573	E PAVAN CHANDRA
15	14R11A0574	G BHAVANA
16	14R11A0575	G KISHAN
17	14R11A0576	G LASYA PRIYA
18	14R11A0577	G SIRIVENNELA
19	14R11A0578	GANAPATHI RAJU MADHURI
20	14R11A0579	GANGAVARAPU MANASA
21	14R11A0580	GATTOJI HARITHA
22	14R11A0581	GAYATHRI MANDAL
23	14R11A0582	GORTI SANTOSH KUMAR
24	14R11A0583	HRITIK S
25	14R11A0584	KALYANAM KRUTHIKA REDDY
26	14R11A0585	KANUMURI SRI PRATHYUSHA
27	14R11A0586	KOLLU VINESH BABU
28	14R11A0587	KONDISETTI NIRANJANA KUMARI
29	14R11A0588	KONIKA VENKATA PADMA PRIYA HASINI
30	14R11A0589	KURUP MEGHANA
31	14R11A0590	MADARAJU RAMYA SAI
32	14R11A0591	MEDIPALLY SRIYA
33	14R11A0592	MUDDU DEEPTHI
34	14R11A0593	N LAHARI
35	14R11A0594	N VIKHYAT
36	14R11A0595	NAKEERTHA SANDHYA RANI
37	14R11A0596	NALLAMILLI JYOTHI
38	14R11A0597	NALLAPANENI ADITYA SAI
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41	14R11A05A0	ORUGANTI KALPANA
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43	14R11A05A2	PEESAPATI VENKATA SAI VAMSI
44	14R11A05A3	PINDIPOLU SRAVYA
45	14R11A05A4	PRANATHI KRISHNA SANGANI
46	14R11A05A5	PUDHOTA AVINASH

47	14R11A05A6	S ASHA LAKSHMI
48	14R11A05A7	S CHANDANA REDDY
49	14R11A05A8	SHAIK HAFEEZ HUSSAIN
50	14R11A05A9	SHEELAM SUSHMA
51	14R11A05B0	SRAVIKA SANKU
52	14R11A05B1	THUMMALA RISHIKA REDDY
53	14R11A05B2	VARSHA CHAHAL
54	14R11A05B3	VEERAVALLI SHILPA
55	14R11A05B4	VUPPUTTURI SUSHANTH KUMAR
56	14R11A05B5	Y ADITHYA
57	14R11A05B6	YEDDU SHASHI KUMAR
58	14R11A05B7	KATAMONI HARSHITHA
59	15R15A0501	B VINESH
60	15R15A0502	B SHRAVAN KUMAR

Class / Section: CSE 22C

1	14R11A05C0	A S SRUJAN SAI
2	14R11A05C1	AITHA RANJEETH KUMAR
3	14R11A05C2	ALIGETI MAHITHA
4	14R11A05C3	BAGGU VISHNU SAI PRASAD
5	14R11A05C4	BARGELA PRANAY RAJ
6	14R11A05C5	BIROJU SAI SUGANDH CHARY
7	14R11A05C6	G AKHILA
8	14R11A05C7	GANGJI MANISHA
9	14R11A05C8	GARIKAPATI NAMRATHA CHOWDARY
10	14R11A05C9	GARLAPATI RENUKA
11	14R11A05D0	GUNDARAPU SOUJANYA REDDY
12	14R11A05D1	GUNGI SAI KUMAR
13	14R11A05D2	GUNNALA RAMYA SREE
14	14R11A05D3	ILA BHAVANA
15	14R11A05D4	J HEMANTH SAI
16	14R11A05D5	JELLA MOUNICA
17	14R11A05D6	K TEJA ABHINAV
18	14R11A05D7	KANAKADANDI NAGA VENKATA APARNA
19	14R11A05D8	KASI SRAVYA
20	14R11A05D9	KAVYA S
21	14R11A05E0	KUKKALA DEEPIKA
22	14R11A05E1	LAHIRI KOTAMRAJU
23	14R11A05E2	MARAM RAJEEV KUMAR
24	14R11A05E3	MARGONWAR GAYATRI
25	14R11A05E4	MEKALA SWATHI

26	14R11A05E5	MOTHABOINA KAMESHWAR RAO ROHAN MUDH
27	14R11A05E6	NALABOTHULA HARIKA
28	14R11A05E7	NALADALA SAI CHARITHA
29	14R11A05E8	NEMURI SAI SAMPATH GOUD
30	14R11A05E9	NIKHIL THAPA
31	14R11A05F0	P ANUDEEP
32	14R11A05F1	P SAI PRASAD
33	14R11A05F2	PARIMI SAIESH
34	14R11A05F3	PINNINTI SAIKIRAN REDDY
35	14R11A05F4	POLAGOUNI VAISHNAVI GOUD
36	14R11A05F5	POTHURI VENKATA SAI PRIYANKA
37	14R11A05F6	RAHUL N D
38	14R11A05F7	RAI MEGHANA
39	14R11A05F8	RAYALA PRIYANKA
40	14R11A05F9	RAYAPROLU ASWINI
41	14R11A05G0	REEBA FATIMA
42	14R11A05G1	ROSHAN ROY
43	14R11A05G2	S HARI PRASAD
44	14R11A05G3	SAI PRIYA MALLIKA K
45	14R11A05G4	SANKARAMANCHI MOUNIKA
46	14R11A05G5	SEEMALA MAHENDER SUNNY SAMUEL
47	14R11A05G6	SUJAN MOHAN PILLI
48	14R11A05G7	T C KAVERI
49	14R11A05G8	T SWATHI
50	14R11A05G9	TERETIPALLY KARUNA SRI
51	14R11A05H0	V ABHISHEK
52	14R11A05H1	V VENKATA SAI YASASWI
53	14R11A05H2	VALLAP NITHIN REDDY
54	14R11A05H3	VASI SAI DINESH
55	14R11A05H4	VATTI BHARGAVI
56	14R11A05H5	VELPULA SANDHYA RANI
57	14R11A05H6	VIDYA SRIJA VOLETI
58	14R11A05H7	Y SREEJA
59	15R15A0503	MAALOTHU GANESH
60	15R18A0501	SANDEEP G BURUD

Total: 60 Males: 27 Females: 33

Class / Section: CSE 22D

1	14R11A05H9	A SAHITH REDDY
2	14R11A05J0	ADITYA V S P
3	14R11A05J1	ANEM PUNEET SURYA
4	14R11A05J2	ANNAVARAPU NAGA SAI SRILEKHA
5	14R11A05J4	B VINAY
6	14R11A05J5	BALABADRA SNEHA

7	14R11A05J6	BAYYAPU KEERTHANA
8	14R11A05J7	BHASWANTH K
9	14R11A05J8	BIJUMALLA SETHU MADHAV
10	14R11A05J9	BILLA HRIDAY VIKAS
11	14R11A05K0	BOLLEPALLY DIVYA
12	14R11A05K1	BUGATHA BALA GAYATRI
13	14R11A05K2	BYRU AKHILA
14	14R11A05K3	DHONEPUDI SHASHIKANTH
15	14R11A05K4	G DEEPIKA
16	14R11A05K5	GADDAM SUMIKENDAR REDDY
17	14R11A05K6	GARIKIPATI VINEETHA
18	14R11A05K7	GUNISETTY AKHIL
19	14R11A05K8	J ALIVELUMANGAVATHI
20	14R11A05K9	JESSICA SHINY THOMAS
21	14R11A05L0	KANDI SAI JAGADISH
22	14R11A05L1	KARTHIK KALVAGADDA
23	14R11A05L2	KATARAY SAMYUKTHA DEVI
24	14R11A05L3	KATHI GANESH GOUD
25	14R11A05L4	KATKAM SAI SRI
26	14R11A05L5	KATKURI NIHARIKA
27	14R11A05L6	KODANDAM SAI PRATHYUSH REDDY
28	14R11A05L7	KONDOJU ABHISHEK KUMAR
29	14R11A05L8	KOONAPAREDDY ETHESH KUMAR
30	14R11A05L9	MADDURU VENKATA SAI SHRUTHI
31	14R11A05M0	MANDAVILLI LALITH KUMAR
32	14R11A05M1	MARGUM ALEKHYA
33	14R11A05M2	MD AKBAR
34	14R11A05M3	MEKA NAVEENA
35	14R11A05M4	MOHAMMED FURQUAN AHMED
36	14R11A05M5	MOUNIKA V
37	14R11A05M6	MUTHYAM LIKITHA SREE
38	14R11A05M7	NARU SIVA SAI KARTHIK
39	14R11A05M8	NEMANI HEMANTH KUMAR
40	14R11A05M9	NUTHALAKANTI PRANAV KUMAR NANU
41	14R11A05N0	P DIVYA TEJA
42	14R11A05N1	PANANGIPALLI NAGA SAI MOUNIKA
43	14R11A05N2	PATURU NAGA SRI NIKHILENDRA
44	14R11A05N3	PRIYANKA PANDA
45	14R11A05N4	PS MANIVENKAT RATNAM MUTYALA
46	14R11A05N5	R.HARI SHANKER REDDY
47	14R11A05N6	RAMYA DUBAGUNTA
48	14R11A05N7	SATLA MOUNIKA
49	14R11A05N8	SHAIK JAVEERIA
50	14R11A05N9	SINGIREDDY AKHILA
51	14R11A05P0	SINGIREDDY MANEESHA

52	14R11A05P1	SOMIDI LEKHANA
53	14R11A05P2	T HARSHINI
54	14R11A05P3	TALATH FATHIMA
55	14R11A05P4	THOUDOJU RAMAKRISHNA
56	14R11A05P5	TIRUMALARAJU KARTHIK RAMA KRISHNA V
57	14R11A05P6	VALABOJU VAMSHI KRISHNA
58	14R11A05P7	VARUN R SHAH
59	15R15A0504	ACHHI PHANINDRA
60	15R15A0505	P NANDA SAI