



DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE
(AUTONOMOUS)
College with Potential for Excellence, Linguistic Minority Institution
Affiliated to University of Madras
Arumbakkam, Chennai 600 106

LIST OF COURSES INTEGRATING CROSS CUTTING ISSUES

- **PROFESSIONAL ETHICS**
- **GENDER**
- **HUMAN VALUES**
- **ENVIRONMENT & SUSTAINABILITY**

PRINCIPAL
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Vaishnav College
Arumbakkam, Chennai - 600106.



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COURSES RELEVANT TO PROFESSIONAL ETHICS

- **Business Ethics and Values**
- **Corporate Governance, Ethics & Social Responsibility**
 - **Entrepreneurship, Biosafety, Bioethics and Intellectual Property Rights**
- **Research Methodology, Bioethics & Biostatistics**
 - **Biosafety & Clinical Research**
 - **Media Laws and Ethics**

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SPECIALISED COURSE II

CORPORATE GOVERNANCE, ETHICS AND SOCIAL RESPONSIBILITY

Course Code:	Credits : 04	CIA Marks: 40
P:S	:4:0:0:0	ESE Marks : 60
Hour	:03	

Course Outcomes: At the end of the Course, the Student will be able to:

Deliberate the details of the concept of ethics and related terms or connotations, business values, business ethics and its various approaches, theories, Social responsibilities and corporate ethics.	K1 & K3
Learn the frame work of corporate governance: Evolution and development in India. Regulatory frame work of corporate governance in India. SEBI guidelines and Clause 49.	K1 & K2
Understand in details about Management vs. Governance :Internal constitues of the corporate governance : key managerial personnel: chairman . chief executive officer, company secretary.	K3 & K4
Identify the concept of Whistle Blowing; whistle blower policy in India.	K5 & K6
Explain Corporate social responsibilities; Corporate sustainability, Reporting, CSR and Business ethics ; Corporate Governance ;environmental aspects of CSR, Models, drivers of CSR: CSR initiatives in India.	K6
Demonstrate an enhanced application for the relevance and practical application of ethics in management of business	K5

Mapping of Course Outcomes to Program Outcomes:

PO/ PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3	1	3	3	1	3	3	3
CO2	2	2	3	3	1	3	3	3
CO3	3	1	3	3	1	2	3	3
CO4	3	3	3	3	1	3	3	3
CO5	3	3	3	3	2	3	3	3
CO6	3	3	3	3	3	3	2	3
Average	2.83	2.17	3.00	3.00	1.50	3.00	3.00	3.00
Correlation	3= Strong 2= Medium 1= Low							

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ASSESSMENT PATTERN

PART A	Answer any 10 out of 12	(10 x 2 = 20)
PART B	Answer any 5 out of 8	(5 x 7 = 35)
PART C	Answer any 3 out of 5	(3 x 5 = 15)

DISTRIBUTION OF QUESTIONS

Section	Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V
A	3	3	2	2	2
B	2	2	2	1	1
C	1	1	1	1	1

CIA- Continuous Internal Assessment (40 Marks)

Category (out of 50)	Tests	Assignments	Quizzes	Current Affairs quizzes
Remember	20	5	5	10
Understand		5	5	
Apply	10			10
Analyse	5			
Evaluate	5			
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	30
Analyse	15
Evaluate	10
Create	5

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE (AUTONOMOUS)
PG & RESEARCH DEPARTMENT OF COMMERCE – SHIFT I

Time Table for the Odd Semester 2021-2022

Name of the Staff: Dr. J. Jayasankar

D/O	1	2	3	4	5
I	II M. COM	I M. COM			
II	II M. COM				
III	II M. COM	I M. COM			
IV	I M. COM				
V	I M. COM				
VI	II M. COM				

Head of the Department

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PG & RESEARCH DEPARTMENT OF COMMERCE – SHIFT I

Time Table for the Even Semester February 2022

Name of the Staff: Prof. S. Seshadrinathan

D/O	1	2	3	4	5
I		I A	II M. COM		
II		I B	II M. COM		
III				II M. COM	
IV			II M. COM	I C	
V			I M. COM		
VI				I M. COM	

Head of the Department

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PG & RESEARCH DEPARTMENT OF COMMERCE – SHIFT I

Time Table for the Even Semester February 2022

Name of the Staff: Dr. J. Satish

D/O	1	2	3	4	5
I		II M. COM		II A	I A
II		I A	I M. COM		
III		II M. COM	II B	I B	
IV		I M. COM			I B
V	I C			II C	
VI			I C	II C	

Head of the Department

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PG & RESEARCH DEPARTMENT OF COMMERCE – SHIFT I

Time Table for the Even Semester February 2022

Name of the Staff: Dr. B. Vijayakumar

D/O	1	2	3	4	5
I		III A	II A		
II		I M. COM	III C		
III		II B	III B		
IV		III A	II C	I M. COM	
V			I M. COM	III B	
VI		II B	III C		II M. COM

Head of the Department

DWARAK DOSS GOVERDHAN DOSS VAISHNAV COLLEGE
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POST GRADUATE & RESEARCH DEPARTMENT OF COMMERCE
CIA TEST - I

CLASS: I M.Com
SUB: CORPORATE GOVERNANCE, ETHICS & RESPONSIBILITIES
SUB.CODE:20208

DATE: 11.03.2021
MARKS: 50
TIME: 90 MTS

SECTION – A

Answer any FIVE questions:

5X2=10

1. Define Corporate Ethics
2. Who are the rating agencies in India?
3. What is Whistle blowing?
4. What is Corporate Governance?
5. What is CSR?
6. What is the role of CEO?
7. What is CFO?

SECTION – B

Answer any FOUR questions:

4X5=20

8. What are the principles of ethics?
9. Discuss the benefits of CSR
10. Explain the importance of Ethics
11. Explain the relationship between CSR & Corporate Governance
12. Explain the concept of Whistle blowing
13. What is CSR and triple bottom line?

SECTION – C

Answer any TWO questions:

2X10=20

14. Briefly discuss the various ethical theories
15. Discuss the powers, duties and responsibilities of a Company Secretary
16. Distinguish Corporate Ethics Vs Corporate Governance Vs Corporate Social Responsibility

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COURSES RELEVANT TO GENDER

- **CROSS CULTURAL PSYCHOLOGY**
- **PSYCHOLOGY OF ADOLESCENCE AND EARLY ADULTHOOD**
 - **SOCIAL PSYCHOLOGY II**
 - **COUNSELING & GUIDANCE**
 - **SOCIAL PROBLEMS**
 - **FOUNDATIONS OF VICTIMOLOGY**
 - **WOMEN STUDIES**
 - **WORKING WITH INDIVIDUALS**
 - **WORKING WITH GROUPS**
 - **HUMAN BEHAVIOUR**
 - **WORKING WITH COMMUNITIES**
 - **PSYCHOLOGY**
 - **DEVELOPMENTAL BIOLOGY**
 - **GENETICS**
 - **HUMAN PHYSIOLOGY & NUTRITION**
 - **HORMONAL BIO CHEMISTRY**
- **MICROBIAL GENETICS & MOLECULAR BIOLOGY**



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DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE
DEPARTMENT OF CRIMINOLOGY & POLICE ADMINISTRATION
CONTINUOUS INTERNAL ASSESSMENT – OCTOBER 2021

FOUNDATIONS OF VICTIMOLOGY

TIME : 1 ½ HOURS

Max.marks:50

Section-A (20*1=20 marks)
Answer All the questions

1. ----- is considered as the father of Victimology.
2. An example of *Lex talionis* ----- .
3. The evolution of victim can be classified into three ages. They are ---.
4. The ----- are considered as the period of re-emergence of the victim.
5. Hans von Hentig published his book ----- in the year -----.
6. Social movement can be defined as ----- .
7. Hans von Hentig discussed the ----- role of the victim in his book.
8. Retributive justice is more victim oriented than restitutive justice. (True/False)
9. Rape crisis centers were set up as a result of -----.
10. Separovic is one of the prominent contributors to the development of -----.
11. Forensic Victimology is the study of -----.
12. Victimology is the scientific study of -----, ----- and -----.
13. Reaction to victims and victimization includes both ---- and ---- reactions.
14. The term Victimology was first printed by ----- in his book -----.
15. ----- studied victim precipitation in cases of criminal homicide.
16. Stephen Schafer termed the role of the victim in his/her victimization as -----.
17. Victims of a 26/11 Mumbai attack are considered as ----- victims.
18. -----, ----- and ----- are considered as vulnerable victims.
19. Special Victimologists consider Victimology as ----- Criminology.
20. List out the three interactions explored by a Victimologist.

Section-B (6*5=30 marks)

Answer all questions

21. a) Identify the key factors that lead to the development of the criminal justice system.
OR
b) How did the research by Manachem Amir backfire?
22. a) Briefly explain the purpose of Victimology.
OR
b) Summarize the major contributions of Benjamin Mendelshon.
23. a) "Social movement leads to social change" - Discuss within the context of Nirbhaya incident.
OR
b) Appraise the contributions of the Victims' Rights Movement to Victimology.
24. a) Outline the evolution of Victimology.
OR
b) Explain the inter-disciplinary nature of Victimology.
25. a) Examine the different types of victimization faced by a victim of sexual assault.
OR
b) Critically analyze the difference between Criminology & Victimology.
26. a) Using the classifications of General victimology, define and explain victims of medical malpractice, suicide and caste-based violence.
OR
b) Compare the typologies of victims proposed by Hentig and Schafer.



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Department of Biochemistry

Time table- 2021-2022(ODD SEMESTER)

Faculty: Dr.G.Sriram Prasath ,MSc, PhD,NET

DAY ORDER	I	II	III	IV	V
I			IMSC(PBC)	IIIBSC(MB)	
II			IMSC(PBC)		IIMSc(HBC)
III				IIMSc(HBC)	IMSC(PBC)
IV	IMSc(PBC)		IIIBSc(MB)	IBSC Practical	IBSC Practical
V		IMSc(PBC)	IIMSc(HBC)		
VI				III BSc Practical	III BSc Practical

PBC-Plant biochemistry Theory

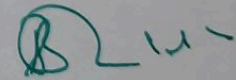
HBC-Harmonal biochemistry Theory

MB-Molecular biology Theory

5 hrs/day- 6 Day order

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COURSES RELEVANT TO HUMAN VALUES
VALUE EDUCATION



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APPENDIX – 32 (S)

UNIVERSITY OF MADRAS

CHOICE BASED CREDIT SYSTEM

PART-IV VALUE EDUCATION

Common for all U.G. & Five Year Integrated Courses

(Effective from the Academic Year 2012-2013)

SYLLABUS

PART-IV VALUE EDUCATION - III YEAR – FIFTH SEMESTER CREDITS : 2

Objective : Values are socially accepted norms to evaluate objects, persons, and situations that form part and parcel of sociality. A value system is a set of consistent values and measures. Knowledge of the values are inculcated through education. It contributes in forming true human being, who are able to face life and make it meaningful. There are different kinds of values like, ethical or moral values, doctrinal or ideological values, social values and aesthetic values. Values can be defined as broad preferences concerning appropriate courses of action or outcomes. As such, values reflect a person's sense of right and wrong or what "ought" to be. There are representative values like, "Equal rights for all", "Excellence deserves admiration". "People should be treated with respect and dignity". Values tend to influence attitudes and behavior and help to solve common human problems. Values are related to the norms of a culture.

Unit I: Value education-its purpose and significance in the present world – Value system – The role of culture and civilization-Holistic living – Balancing the outer and inner – Body, Mind and Intellectual level- Duties and responsibilities.

Unit II : Salient values for life- Truth, commitment, honesty and integrity, forgiveness and love, empathy and ability to sacrifice, care, unity , and inclusiveness, Self esteem and self confidence, punctuality – Time, task and resource management – Problem solving and decision making skills- Interpersonal and Intra personal relationship – Team work – Positive and creative thinking


Unit III : Human Rights – Universal Declaration of Human Rights – Human Rights violations – National Integration – Peace and non-violence – Dr. A.P.J Kalam's ten points for enlightened citizenship – Social Values and Welfare of the citizen – The role of media in value building.

Unit IV: Environment and Ecological balance – interdependence of all beings – living and non-living. The binding of man and nature – Environment conservation and enrichment.

Unit V : Social Evils – Corruption, Cyber crime, Terrorism – Alcoholism, Drug addiction – Dowry – Domestic violence – untouchability – female infanticide – atrocities against women- How to tackle them

Books for Reference:

1. M.G.Chitakra: Education and Human Values, A.P.H.Publishing Corporation, New Delhi, 2003


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2. Chakravarthy, S.K. : Values and ethics for Organizations: Theory and Practice, Oxford University Press, New Delhi , 1999.
3. Satchidananda, M.K.: Ethics, Education, Indian Unity and Culture, Ajantha Publications, Delhi, 1991
4. Das, M.S. & Gupta, V.K. : Social Values among Young adults: A changing Scenario, M.D. Publications, New Delhi, 1995
5. Bandiste, D.D.: Humanist Values: A Source Book, B.R. Publishing Corporation, Delhi, 1999
6. Ruhela, S.P. : Human Values and education, Sterling Publications, New Delhi, 1986
7. Kaul, G.N.: Values and Education in Independent Indian, Associated Publishers, Mumbai, 1975
8. NCERT, Education in Values, New Delhi, 1992
9. Swami Budhananda (1983) How to Build Character A Primer : Ramakrishna Mission, New Delhi
10. A Cultural Heritage of India (4 Vols.), Bharatiya Vidya Bhavan, Bombay. (Selected Chapters only)
11. For Life, For the future : Reserves and Remains – UNESCO Publication
12. Values, A Vedanta Kesari Presentation, Sri Ramakrishna Math, Chennai, 1996
13. Swami Vivekananda, Youth and Modern India, Ramakrishna Mission, Chennai
14. Swami Vivekananda, Call to the Youth for Nation Building, Advaita Ashrama, Calcutta
15. Awakening Indians to India, Chinmayananda Mission, 2003


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COURSES RELEVANT TO ENVIRONMENT & SUSTAINABILITY

ENVIRONMENTAL ECONOMICS
ENVIRONMENTAL STUDIES

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SYLLABUS - ENVIRONMENTAL STUDIES

Unit 1 : Multidisciplinary nature of environmental studies Definition, scope and importance (2 lectures) Need for public awareness.

Unit 2 : Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems. a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles. (8 lectures)

Unit 3 : Ecosystems • Concept of an ecosystem. • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem. • Ecological succession. • Food chains, food webs and ecological pyramids. • Introduction, types, characteristic features, structure and function of the following ecosystem :- a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit 4 : Biodiversity and its conservation • Introduction - Definition : genetic, species and ecosystem diversity. • Biogeographical 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 V • Hot-spots of biodiversity. • Threats to biodiversity : habitat loss, poaching of wildlife,

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DEPARTMENT OF BOTANY

ENVIRONMENTAL STUDIES -CIA-I

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

Max. Marks: 50

10X1=10

I. Choose the correct answer from the following

1. Environmental studies provides knowledge on
 - a) Richness and conservation of biodiversity
 - b) Relationship of ecosystems
 - c) Understand about environmental pollution and control
 - d) All the above
2. _____ is the example of non-renewable natural resources
 - a) Water
 - b) Solar energy
 - c) Crops
 - d) Coal and petroleum
3. The Wild Life Protection Act was established in
 - a) 1952
 - b) 1972
 - c) 1980
 - d) 1970
4. Global warming will cause the following problem
 - a) Melting of glaciers
 - b) Raising of ocean level
 - c) Sinking of islands
 - d) All the above
5. _____ is an elixir of life
 - a) Air
 - b) Water
 - c) food
 - d) All the above
6. _____ are the pride of India
 - a) a) River
 - b) Ocean
 - c) Dams
 - d) Ponds
7. _____ kilometer above the earth surface is atmosphere
 - a) 500 km
 - b) 1000 km
 - c) 1500 km
 - d) 2000 km
8. The term green revolution was coined by
 - a) M.S.Swaminathan
 - b) Chares Elton
 - c) William Gaud
 - d) E.Odum
9. The region of earth, where life exists is known as
 - a) Hydrosphere
 - b) Biosphere
 - c) Lithosphere
 - d) Atmosphere
10. Which is called as autotrophs?
 - a) Green plants
 - b) Animals
 - c) Birds
 - d) All the above

II. Answer all the following questions

5X2=10

11. Define Ecology?
12. What are the structural components of an Ecosystem?
13. Define producer
14. What is food web?
15. Define ecological pyramid

III. Answer all the following questions

4X5=20

16. Mention the Scope and importance of Environmental studies
17. Differentiate between renewable and non-renewable energy resources
18. Enumerate characteristics of an Ecosystem.
19. What are the factors to be considered in Abiotic eco system?

IV. Answer the following question

1X10=10

20. Describe the structure and functions of pond as an ecosystem



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DEPARTMENT OF BOTANY

ENVIRONMENTAL STUDIES -CIA-II

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

I. Choose the correct answer from the following

10X1=10

1. Biodiversity is very essential for the health of ____
a) Atmosphere b) Hydrosphere c) Lithosphere d) Biosphere
2. Wild life is a gift of nature to be
a) Conserved b) Nurtured c) Protected d) All the above
3. Which of the following agency published the Red data book?
a) IUCN b) NEERI c) NWAP d) CITES
4. WWF stands for
a) World Wide Fund b) World Wildlife Fund for Nature c) Wildlife Wide Fund for Nature and Natural Resources d) World Wild Fund
5. 90% of Global air pollution is produced by
a) Primary air pollutant (b) Secondary air pollutant
b) (c) Greenhouse gases (d) Industries
6. Green consumer day is celebrated on _____
a) Sept-28 b) Oct-28 c) Nov-28 d) Dec-28
7. BOD Stands for
a) Biological Oxygen Demand b) Biological Oxidation Demand
c) Biotic Oxidation Demand d) Biochemical Oxidation Demand
8. June 5th is observed as
a) World Environmental Day b) World Forest Day
c) World Wildlife Day d) World Population Day
9. “Pull Factor” means
(a) People move from rural to cities to get better income
(b) People move from cities rural to get clean environment
(c) People move from rural to cities for availability
(d) People move from cities rural due lack of space
10. The _____ year is celebrated as Women Empowerment year
a) 1981 b) 1991 c) 1995 d) 2001

II. Answer all the following questions

5X2=10

11. What is Biodiversity?
12. Define Green House effect
13. What is Air pollution?
14. Explain Algal bloom.
15. Define Nuclear Accidents

III. Answer all the following questions

4X5=20

16. State the role of individual in prevention of Pollution
17. Explain the values of biodiversity
18. Write short notes on Women and child welfare
19. Waste is wealth-How?

IV. Answer the following question

1X10=10

20. What are the different threats faced by our bio-diversity resource? Explain it.



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End Semester Examinations-NOV-2021
ENVIRONMENTAL STUDIES

Time: 1:30 Hours

Subject code: 09-15/13411/16-20/13412

Max. Marks: 50

I. Choose the Correct Answer

10X1=10

1. **The region of earth, where life exists is known as**
a) Hydrosphere b) Biosphere c) Lithosphere d) Atmosphere
2. **Ozone layer is found in**
a) Thermosphere b) Stratosphere c) Troposphere d) Mesosphere
3. **Water scarcity is mainly caused due to**
a) Over population (b) Low rainfall (c) Over-exploitation (d) Unequal access
4. **_____ is the pride of India**
a) Rivers b) Oceans (c) Dams (d) Ponds
5. **Poverty is a**
a) Economic problem b) Social problem (c) Political problem d) Religious problem
6. **IUCN Stands for**
a) International Union for Conservation of Nature
b) International Union for Conservation of Nature and Natural Resources
c) International Union Council for Nature
d) International Union council for Conservation of Nature and Natural Resources
7. **Red data book contains**
a) All plant species b) All animal species
c) Threatened species d) economically important species
8. **The amount of Oxygen inhaling in a day**
a) 10kg b) 12kg (c) 14kg d) 16kg
9. **Find the correct sequence of 3R slogans**
a) Recycle, Reuse and Reduce b) Reuse, Reduce and Recycle
c) Reduce, Reuse and Recycle d) None of the above
10. **World health day is celebrated on _____ every year**
a) March-7 b) June-7 (c) May-7 d) April-7

II. Answer any FIVE Questions. All questions carry equal marks 5X2=10

11. Define Ecosystem
12. What is Biodiversity?
13. What is Green House Effect?
14. Define ecological pyramid
15. How does earthquake occur?
16. Differentiate between food chain and food web
17. What is Deforestation?
18. Define HIV/AIDS

III. Answer any THREE Questions. All questions carry equal marks 2X5=10

19. Write a note on scope of environmental studies?
20. Discuss the effects of air pollution on Human health and vegetation
21. Define Biodiversity. Discuss the factors affecting Biodiversity
22. Waste is wealth-How?
23. Write short notes on Women and child welfare

IV. Answer any TWO Questions. All questions carry equal marks 2X10=20

24. Explain briefly about global warming. Add a note on its control measures.
25. Critically examine the causes, effects and control measures of water pollution?
26. Explain the following:
 - a) Cyclones
 - b) Floods
 - c) Earth quakes
 - d) Tsunami
27. What are the best ways will you follow for plastic free life



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DEPARTMENT OF BOTANY

STUDY MATERIALS FOR ENVIRONMENTAL STUDIES

UNIT-I

1.1 DEFINITION, SCOPE AND IMPORTANCE

1.1.1 Definition

Environmental studies deals with every issue that affects an organism. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impacts on its integrity. It is an applied science as it seeks practical answers to making human civilization sustainable on the earth's finite resources.

Its components include biology, geology, chemistry, physics, engineering, sociology, health, anthropology, economics, statistics, computers and philosophy.

1.1.2 Scope

As we look around at the area in which we live, we see that our surroundings were originally a natural landscape such as a forest, a river, a mountain, a desert, or a combination of these elements. Most of us live in landscapes that have been heavily modified by human beings, in villages, towns or cities. But even those of us who live in cities get our food supply from surrounding villages and these in turn are dependent on natural landscapes such as forests, grasslands, rivers, seashores, for resources such as water for agriculture, fuel wood, fodder, and fish. Thus our daily lives are linked with our surroundings and inevitably affects them. We use water to drink and for other day-to-day activities. We breathe air, we use resources from which food is made and we depend on the community of living plants and animals which form a web of life, of which we are also a part. Everything around us forms our environment and our lives depend on keeping its vital systems as intact as possible.

Our dependence on nature is so great that we cannot continue to live without protecting the earth's environmental resources. Thus most traditions refer to our environment as 'Mother Nature' and most traditional societies have learned that respecting nature is vital for their livelihoods. This has led to many cultural practices that helped traditional societies protect and preserve their natural resources. Respect for nature and all living creatures is not new to India. All our traditions are based on these values. Emperor Ashoka's edict proclaimed that all forms of life are important for our wellbeing in Fourth Century BC.

Over the past 200 years however, modern societies began to believe that easy answers to the question of producing more resources could be provided by means of technological innovations. For example, though growing more food by using fertilizers and pesticides, developing better strains of domestic animals and crops, irrigating farmland through mega dams and developing industry, led to rapid economic growth, the ill effects of this type of development, led to environmental degradation.

The industrial development and intensive agriculture that provides the goods for our increasingly consumer oriented society uses up large amounts of natural resources such as water, minerals, petroleum products, wood, etc. Nonrenewable resources, such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations. Renewable resources, such as timber and water, are those which can be used but can be regenerated by natural processes such as regrowth or rainfall. But these too will be depleted if we continue to use them faster than nature can replace them.

For example, if the removal of timber and firewood from a forest is faster than the regrowth and regeneration of trees, it cannot replenish the supply and loss of forest cover not only depletes the forest of its resources, such as timber and other non-wood products, but affect our water resources because an intact natural forest acts like a sponge which holds water and releases it slowly. Deforestation leads to floods in the monsoon and dry rivers once the rains are over. Such multiple effects on the environment resulting from routine human activities must be appreciated by each one of us, if it is to provide us with the resources we need in the long-term.

Our natural resources can be compared with money in a bank. If we use it rapidly, the capital will be reduced to zero. On the other hand, if we use only the interest, it can sustain us over the longer term. This is called sustainable utilization or development.

1.1.3 Importance

Environment is not a single subject. It is an integration of several subjects that include both Science and Social Studies. To understand all the different aspects of our environment we need to understand biology, chemistry, physics, geography, resource management, economics and population issues. Thus the scope of environmental studies is extremely wide and covers some aspects of nearly every major discipline. We live in a world in which natural resources are limited. Water, air, soil, minerals, oil, the products we get from forests, grasslands, oceans and from agriculture and livestock, are all a part of our life support systems. Without them, life itself would be impossible. As we keep increasing in numbers and the quantity of resources.

Each of us uses also increases, the earth's resource base must inevitably shrink. The earth cannot be expected to sustain this expanding level of utilization of resources. Added to this is misuse of resources. We waste or pollute large amounts of nature's clean water; we create more and more material like plastic that we discard after a single use; and we waste colossal amounts of food, which is discarded as garbage. Manufacturing processes create solid waste byproducts that are discarded, as well as chemicals that flow out as liquid waste and pollute water, and gases that pollute the air. Increasing amounts of waste cannot be managed by natural processes. These accumulate in our environment, leading to a variety of diseases and other adverse environmental impacts now seriously affecting all our lives. Air pollution leads to respiratory diseases, water pollution to gastro-intestinal diseases, and many pollutants are known to cause cancer. Improving this situation will only happen if each of us begins to take actions in our daily lives that will help preserve our environmental resources. We cannot expect Governments alone to manage the safeguarding of the environment, nor can we expect other people to prevent environmental damage. We need to do it ourselves. It is a responsibility that each of us must take on as one's own.

The Multidisciplinary Nature of Environmental Studies

Productive value of nature: As scientists make new advances in fields such as biotechnology we begin to understand that the world's species contain an incredible and uncountable number of complex chemicals. These are the raw materials that are used for developing new medicines and industrial products and are a storehouse from which to develop thousands of new products in the future. The flowering plants and insects that form the most species rich groups of living organisms are thus vital for the future development of man. If we degrade their habitat these species will become extinct. If one sees being sold or used, a product that comes from an illegally killed wild species, if we do not inform the authorities, we become party to its extinction. Once they are lost, man cannot bring them back. When we permit the destruction of a forest, wetland or other natural area and do not protest about it, future generations are being denied the use of these valuable resources and will blame us for these rash and negligent actions towards the environment. Thus the urgent need to protect all living species is a concept that we need to understand and act upon. While individually, we perhaps cannot directly prevent the extinction of a species, creating a strong public opinion to protect the National Parks and Wildlife Sanctuaries in which wild species live is an importance aspect of sustainable living. There is a close link between agriculture and the forest, which illustrates its productive value. For crops to be successful, the flowers of fruit trees and vegetables must be pollinated by insects, bats and birds. Their life cycles however frequently require intact forests.

A wilderness experience has exceptional recreational value. This has been described as nature tourism, or wildlife tourism, and is also one aspect of adventure tourism. These recreational facilities not only provide a pleasurable experience but are intended to create a deep respect and love for nature. They are also key tools in educating people about the fragility of the environment and the need for sustainable lifestyles. In an urban setting, green spaces and gardens are vital to the psychological and physical health of city dwellers. It provides not only an aesthetic and visual appeal but the ability to ensure that each individual is able to access a certain amount of peace and tranquility. Thus urban environmental planners must ensure that these facilities are created in growing urban complexes. Another important conservation education facility in urban settings includes the need to set up well designed and properly managed zoological parks and aquariums. These have got great value in sensitizing school students to wildlife. Many young people who frequented zoos as young children grow up to love wildlife and become conservationists.

Enormous quantities of waste, we as a generation will leave nothing for future generations. Our present generation has developed its economies and lifestyles on unsustainable patterns of life. however, nature provides us with various options on how we utilize its goods and services. This is its option value. We can use up goods and services greedily and destroy its integrity and long term values, or we can use its resources sustainably and reduce our impacts on the environment. The option value allows us to use its resources sustainably and preserve its goods and services for the future.

1.2 NEED FOR PUBLIC AWARENESS

As the earth's natural resources are dwindling and our environment is being increasingly degraded by human activities, it is evident that something needs to be done. We often feel that managing all this is something that the Government should do. But if we go on endangering our environment, there is no

way in which the Government can perform all these clean-up functions. It is the prevention of environment degradation in which we must all take part that must become a part of all our lives. Just as for any disease, prevention is better than cure. To prevent ill-effects on our environment by our actions, is economically more viable than cleaning up the environment once it is damaged. Individually we can play a major role in environment management. We can reduce wasting natural resources and we can act as watchdogs that inform the Government about sources that lead to pollution and degradation of our environment.

This can only be made possible through mass public awareness. Mass media such as newspapers, radio, television, strongly influence public opinion. However, someone has to bring this about. If each of us feels strongly about the environment, the press and media will add to our efforts. Politicians in a democracy always respond positively to a strong publicly supported movement. Thus if you join an NGO that supports conservation, politicians will make green policies. We are living on spaceship earth with a limited supply of resources. Each of us is responsible for spreading this message to as many people as possible.

Suggested further activities for concerned students:

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

1.2.1 Institutions in Environment

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

People in Environment

There are several internationally known environmental thinkers. Among those who have made landmarks, the names that are usually mentioned are Charles Darwin, Ralph Emerson, Henry Thoreau, John Muir, Aldo Leopold, Rachel Carson and EO Wilson. Each of these thinkers looked at the environment from a completely different perspective. Charles Darwin wrote the 'Origin of Species', which brought to light the close relationship between habitats and species. It brought about a new thinking of man's relationship with other species that was based on evolution. Alfred Wallace came to the same conclusions during his work. Ralph Emerson spoke of the dangers of commerce to our environment way back in the 1840s. Henry Thoreau in the 1860s wrote that the wilderness should be preserved after he lived in the wild for a year. He felt that most people did not care for nature and would sell it off for a small sum of money.

S P Godrej was one of India's greatest supporters of wildlife conservation and nature awareness programs. Between 1975 and 1999, SP Godrej received 10 awards for his conservation activities. He was awarded the Padma Bhushan in 1999. His friendship with people in power combined with his deep commitment for conservation led to his playing a major advocacy role for wildlife in India. M S Swaminathan is one of India's foremost agricultural scientists and has also been concerned with various aspects of biodiversity conservation both of cultivars and wild biodiversity. He has founded the MS Swaminathan Research Foundation in Chennai, which does work on the conservation of biological diversity.

NATURAL RESOURCES

INTRODUCTION

Our environment provides us with a variety of goods and services necessary for our day to day lives. These natural resources include, air, water, soil, minerals, along with the climate and solar energy, which form the non-living or 'abiotic' part of nature. The 'biotic' or living parts of nature consists of plants and animals, including microbes. Plants and animals can only survive as communities of different organisms, all closely linked to each in their own habitat, and requiring specific abiotic conditions. Thus, forests, grasslands, deserts, mountains, rivers, lakes and the marine environment all form habitats for specialised communities of plants and animals to live in. Interactions between the abiotic aspects of nature and specific living organisms together form ecosystems of various types. Many of these living organisms are used as our food resources. Others are linked to our food less directly, such as pollinators and dispersers of plants, soil animals like worms, which recycle nutrients for plant growth, and fungi and termites that break up dead plant material so that micro-organisms can act on the detritus to reform soil nutrients.

Earth's Resources and Man: The resources on which mankind is dependent are provided by various sources or 'spheres'.

1) Atmosphere • Oxygen for human respiration (metabolic requirements). • Oxygen for wild fauna in natural ecosystems and domestic animals used by man as food. • Oxygen as a part of carbon dioxide, used for the growth of plants (in turn are used by man).

The atmosphere forms a protective shell over the earth. The lowest layer, the troposphere, the only part warm enough for us to survive in, is only 12 kilometers thick. The stratosphere is 50 kilometers thick and contains a layer of sulphates which is important for the formation of rain. It

also contains a layer of ozone, which absorbs ultra-violet light known to cause cancer and without which, no life could exist on earth. The atmosphere is not uniformly warmed by the sun. This leads to air flows and variations in climate, temperature and rainfall in different parts of the earth. It is a complex dynamic system. If its nature is disrupted it affects all mankind. Most air pollutants have both global and regional effects.

Living creatures cannot survive without air even for a span of a few minutes. To continue to support life, air must be kept clean. Major pollutants of air are created by industrial units that release various gases such as carbon dioxide, carbon monoxide and toxic fumes into the air. Air is also polluted by burning fossil fuels. The buildup of carbon dioxide which is known as 'greenhouse effect' in the atmosphere is leading to current global warming. The growing number of scooters, motorcycles, cars, buses and trucks which run on fossil fuel (petrol and diesel) is a major cause of air pollution in cities and along highways.

Air pollution leads to acute and chronic respiratory diseases such as various lung infections, asthma and even cancer.

2) Hydrosphere • Clean water for drinking (a metabolic requirement for living processes). • Water for washing and cooking. • Water used in agriculture and industry. • Food resources from the sea, including fish, crustacea, sea weed, etc. • Food from fresh water sources, including fish, crustacea and aquatic plants. • Water flowing down from mountain ranges harnessed to generate electricity in hydroelectric projects.

3) Lithosphere • Soil, the basis for agriculture to provide us with food. • Stone, sand and gravel, used for construction. • Micronutrients in soil, essential for plant growth. • Microscopic flora, small soil fauna and fungi in soil, important living organisms of the lithosphere, which break down plant litter as well as animal wastes to provide nutrients for plants. • A large number of minerals on which our industries are based. • Oil, coal and gas, extracted from underground sources. It provides power for vehicles, agricultural machinery, industry, and for our homes.

4) Biosphere • Food, from crops and domestic animals, providing human metabolic requirements. • Food, for all forms of life which live as interdependent species in a community and form food chains in nature on which man is dependent. • Energy needs: Biomass fuel wood collected from forests and plantations, along with other forms of organic matter, used as a source of energy. • Timber and other construction materials.

2.2 RENEWABLE AND NON-RENEWABLE RESOURCES

Ecosystems act as resource producers and processors. Solar energy is the main driving force of ecological systems, providing energy for the growth of plants in forests, grasslands and aquatic ecosystems. A forest recycles its plant material slowly by continuously returning its dead material, leaves, branches, etc. to the soil. Grasslands recycle material much faster than forests as the grass dries up after the rains are over every year. All the aquatic ecosystems are also solar energy dependent and have cycles of growth when plant life spreads and aquatic animals breed. The sun also drives the water cycle. Our food comes from both natural and agricultural ecosystems. The unequal consumption of natural resources: A major part of natural resources are today consumed in the technologically advanced or 'developed' world, usually termed 'the North'. The 'developing nations' of 'the South', including India and China, also over use many

resources because of their greater human population. However, the consumption of resources per capita (per individual) of the developed countries is up to 50 times greater than in most developing countries. Advanced countries produce over 75% of global industrial waste and greenhouse gases the world's population consumes about 25% of the world's resources.

Producing animal food for human consumption requires more land than growing crops. Thus countries that are highly dependent on non-vegetarian diets need much larger areas for pastureland than those where the people are mainly vegetarian.

The need for sustainable lifestyles: The quality of human life and the quality of ecosystems on earth are indicators of the sustainable use of resources. There are clear indicators of sustainable lifestyles in human life.

- Increased longevity
- An increase in knowledge
- An enhancement of income.

These three together are known as the 'Human development index'.

The quality of the ecosystems have indicators that are more difficult to assess.

- A stabilized population.
- The long term conservation of biodiversity.
- The careful long-term use of natural resources.
- The prevention of degradation and pollution of the environment.

2.2.2 Non-renewable resources

These are minerals that have been formed in the lithosphere over millions of years and constitute a closed system. These non-renewable resources, once used, remain on earth in a different form and, unless recycled, become waste material.

Non-renewable resources include fossil fuels such as oil and coal, which if extracted at the present rate, will soon be totally used up. The end products of fossil fuels are in the form of heat and mechanical energy and chemical compounds, which cannot be reconstituted as a resource.

2.2.3 Renewable resources

Though water and biological living resources are considered renewable. They are in fact renewable only within certain limits. They are linked to natural cycles such as the water cycle.

- Fresh water (even after being used) is evaporated by the sun's energy, forms water vapour and is reformed in clouds and falls to earth as rain. However, water sources can be overused or wasted to such an extent that they locally run dry. Water sources can be so heavily polluted by sewage and toxic substances that it becomes impossible to use the water.
- Forests, once destroyed take thousands of years to regrow into fully developed natural ecosystems with their full complement of species. Forests thus can be said to behave like non-renewable resources if overused.
- Fish are today being over-harvested until the catch has become a fraction of the original resource and the fish are incapable of breeding successfully to replenish the population.
- The output of agricultural land if mismanaged drops drastically.
- When the population of a species of plant or animal is reduced by human activities, until it cannot reproduce fast enough to maintain a viable number, the species becomes extinct.

- Many species are probably becoming extinct without us even knowing, and other linked species are affected by their loss.

a) Forest Resources

Use and overexploitation: Scientists estimate that India should ideally have 33 percent of its land under forests. Today we have only about 12 percent. Thus we need not only to protect existing forests but also to increase our forest cover.

People who live in or near forests know the value of forest resources first hand because their lives and livelihoods depend directly on these resources. However, the rest of us also derive great benefits from the forests which we are rarely aware of. The water we use depends on the existence of forests on the watersheds around river valleys. Our homes, furniture and paper are made from wood from the forest. We use many medicines that are based on forest produce. And we depend on the oxygen that plants give out and the removal of carbon dioxide we breathe out from the air.

Forests once extended over large tracts of our country. People have used forests in our country for thousands of years. As agriculture spread the forests were left in patches which were controlled mostly by tribal people. They hunted animals and gathered plants and lived entirely on forest resources. Deforestation became a major concern in British times when a large amount of timber was extracted for building their ships. This led the British to develop scientific forestry in India. They however alienated local people by creating Reserved and Protected Forests which curtailed access to the resources. This led to a loss of stake in the conservation of the forests which led to a gradual degradation and fragmentation of forests across the length and breadth of the country.

FOREST FUNCTIONS

Watershed protection: • Reduce the rate of surface run-off of water. • Prevent flash floods and soil erosion. • Produces prolonged gradual run-off and thus prevent effects of drought.

Atmospheric regulation: • Absorption of solar heat during evapo-transpiration. • Maintaining carbon dioxide levels for plant growth. • Maintaining the local climatic conditions.

Erosion control: • Holding soil (by preventing rain from directly washing soil away).

Land bank: • Maintenance of soil nutrients and structure.

Local use - Consumption of forest produce by local people who collect it for subsistence – (Consumptive use) • Food - gathering plants, fishing, hunting from the forest. (In the past when wildlife was plentiful, people could hunt and kill animals for food. Now that populations of most wildlife species have diminished, continued hunting would lead to extinction.) • Fodder - for cattle. • Fuel wood and charcoal for cooking, heating. • Poles - building homes especially in rural and wilderness areas. • Timber – household articles and construction. • Fiber - weaving of baskets, ropes, nets, string, etc. • Sericulture – for silk. • Apiculture - bees for honey, forest bees also pollinate crops. • Medicinal plants - traditionally used medicines, investigating them as potential source for new modern drugs.

Deforestation: Where civilizations have looked after forests by using forest resources cautiously, they have prospered, where forests were destroyed, the people were gradually impoverished. Today logging and mining are serious causes of loss of forests in our country and all over the world. Dams built for hydroelectric power or irrigation have submerged forests and have displaced tribal people whose lives are closely knit to the forest. This has become a serious cause of concern in India.

One of India's serious environmental problems is forest degradation due to timber extraction and our dependence on fuelwood. A large number of poor rural people are still highly dependent on wood to cook their meals and heat their homes. We have not been able to plant enough trees to support the need for timber and fuelwood.

The National Forest Policy of 1988 now gives an added importance to JFM. Another resolution in 1990 provided a formal structure for community participation through the formation of Village Forest Committees. Based on these experiences, new JFM guidelines were issued in 2000. This stipulates that at least 25 per cent of the income from the area must go to the community. From the initiation of the program, until 2002, there were 63,618 JFM Committees managing over 140,953 sq. km of forest under JFM in 27 States in India.

CASE STUDY

Joint Forest Management

The need to include local communities in Forest Management has become a growing concern. Local people will only support greening an area if they can see some economic benefit from conservation. An informal arrangement between local communities and the Forest Department began in 1972, in Midnapore District of West Bengal. JFM has now evolved into a formal agreement which identifies and respects the local community's rights and benefits that they need from forest resources. Under JFM schemes, Forest Protection Committees from local community members are formed. They participate in restoring green cover and protect the area from being over exploited.

b) Water resources

The water cycle, through evaporation and precipitation, maintains hydrological systems which form rivers and lakes and support in a variety of aquatic ecosystems. Wetlands are intermediate forms between terrestrial and aquatic ecosystems and contain species of plants and animals that are highly moisture dependent. All aquatic ecosystems are used by a large number of people for their daily needs such as drinking water, washing, cooking, watering animals, and irrigating fields. The world depends on a limited quantity of fresh water. Water covers 70% of the earth's surface but only 3% of this is fresh water. Of this, 2% is in polar ice caps and only 1% is usable water in rivers, lakes and subsoil aquifers. Only a fraction of this can be actually used. At a global level 70% of water is used for agriculture about 25% for industry and only 5% for domestic use. However this varies in different countries and industrialized countries use a greater percentage for industry. India uses 90% for agriculture, 7% for industry and 3% for domestic use.

Overutilization and pollution of surface and groundwater: With the growth of human population there is an increasing need for larger amounts of water to fulfill a variety of basic needs. Today in many areas this requirement cannot be met. Overutilization of water occurs at various levels. Most people use more water than they really need.

Deforestation in the Himalayas causes floods that year after year kill people, damage crops and destroy homes in the Ganges and its tributaries and the Brahmaputra. Rivers change their course during floods and tons of valuable soil is lost to the sea. As the forests are degraded, rainwater no longer percolates slowly into the subsoil but runs off down the mountainside bearing large amounts of topsoil. This blocks rivers temporarily but gives way as the pressure mounts allowing enormous quantities of water to wash suddenly down into the plains below. There, rivers swell, burst their banks and flood waters spread to engulf peoples' farms and homes.

CASE STUDY

Water pollution - Nepal

The Narayani River of Nepal has been polluted by factories located on its bank. This has endangered fish, dolphins, crocodiles and other flora and fauna of the region.

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irregular periods of famine. Agriculturists have no income in these bad years, and as they have no steady income, they have a constant fear of droughts. India has 'Drought Prone Areas Development Programs', which are used in such areas to buffer the effects of droughts. Under these schemes, people are given wages in bad years to build roads, minor irrigation works and plantation programs.

Drought has been a major problem in our country especially in arid regions. It is an unpredictable climatic condition and occurs due to the failure of one or more monsoons. It varies in frequency in different parts of our country.

2.3 ROLE OF AN INDIVIDUAL IN CONSERVATION OF NATURAL RESOURCES

Until fairly recently mankind acted as if he could go on for ever exploiting the ecosystems and natural resources such as soil, water, forests and grasslands on the Earth's surface and extracting minerals and fossil fuels from underground. But, in the last few decades, it has become increasingly evident that the global ecosystem has the capacity to sustain only a limited level of utilization. Biological systems cannot go on replenishing resources if they are overused or misused. At a critical point, increasing pressure destabilizes their natural balance. Even biological resources traditionally classified as 'renewable' - such as those from our oceans, forests, grasslands and wetlands, are being degraded by overuse and may be permanently destroyed. And no natural resource is limitless. 'Non-renewable' resources will be rapidly exhausted if we continue to use them as intensively as at present.

CASE STUDY

Selenium – Punjab

In 1981-82, farmers from Hoshirapur and Nawanshehar Districts approached scientists of the Punjab Agricultural University (PAU), Ludhiana, as wheat crops had turned white. Soil analysis indicated selenium (Se) levels in the area were above toxic limits. Se is a naturally occurring trace element, essential for animal and human health, but the gap between requirement and excess is narrow. Soils containing 0.5 microgrammes (ug) of Se per kg or more are injurious to health. In some areas of Punjab, Se levels ranges from 0.31 ug/kg to 4.55ug/kg. Rice cultivation requires the presence of standing water. Being highly soluble, Se dissolves and comes to the surface. The water then evaporates leaving the Se behind function alone. The soil is enriched by the leaf litter of the forest. This detritus is broken down by soil micro-organisms, fungi, worms and insects, which help to recycle nutrients in the system. Further losses of our soil wealth will impoverish our country and reduce its capacity to grow enough food in future.

- A pressure cooker can save up to 75 percent of energy required for cooking. It is also faster.
- Keeping the vessel covered with a lid during cooking, helps to cook faster, thus saving energy.

2.4 EQUITABLE USE OF RESOURCES FOR SUSTAINABLE LIFESTYLES

Reduction of the unsustainable and unequal use of resources, and control of our population growth are essential for the survival of our nation and indeed of human kind everywhere. Our environment provides us with a variety of goods and services necessary for our day-to-day lives, but the soil, water, climate and solar energy which form the 'abiotic' support that we derive from nature, are in themselves not distributed evenly throughout the world or within countries. A new economic order at the global and at national.

UNIT 3: Ecosystems

3.1 CONCEPT OF AN ECOSYSTEM 3.1 CONCEPT OF AN ECOSYSTEM

An 'Ecosystem' is a region with a specific and recognizable landscape form such as forest, grassland, desert, wetland or coastal area. The nature of the ecosystem is based on its geographical features such as hills, mountains, plains, rivers, lakes, coastal areas or islands. It is also controlled by climatic conditions such as the amount of sunlight, the temperature and the rainfall in the region. The geographical, climatic and soil characteristics form its non-living (abiotic) component. These features create conditions that support a community of plants and animals that evolution has produced to live in these specific conditions. The living part of the ecosystem is referred to as its biotic component.

Ecosystems are divided into terrestrial or land based ecosystems, and aquatic ecosystems in water. These form the two major habitat conditions for the Earth's living organisms.

All the living organisms in an area live in communities of plants and animals. They interact with their non-living environment, and with each other at different points in time for a large number of reasons. Life can exist only in a small proportion of the earth's land, water and its atmosphere. At a global level the thin skin of the earth on the land, the sea and the air, forms the biosphere.

At a sub-global level, this is divided into biogeographical realms, geographical realms, geographical realms, geographical realms, geographical realms, eg. Eurasia called the palaeartic realm; South and South-East Asia (of which India forms a major part) is the Oriental realm; North America is the Nearctic realm; South America forms the Neotropical realm; Africa the Ethiopian realm; and Australia the Australian realm. At a national or state level, this forms biogeobiogeobiogeobiogeobiogeographic regions. graphic regions. graphic regions. graphic regions. graphic regions. There are several distinctive geographical regions in India- the Himalayas, the Gangetic Plains, the Highlands of Central India.

Definition: The living community of plants and animals in any area together with the non-living components of the environment such as soil, air and water, constitute the ecosystem.

Some ecosystems are fairly robust and are less affected by a certain level of human disturbance. Others are highly fragile and are quickly destroyed by human activities. Mountain ecosystems are extremely fragile as degradation of forest cover leads to severe erosion of soil and changes in river courses. Island ecosystems are easily affected by any form of human activity which can lead to the rapid extinction of several of their unique species of plants and animals. Evergreen forests and coral reefs are also examples of species rich fragile ecosystems which must be protected against a variety of human activities that lead to their degradation. River and wetland ecosystems can be seriously affected by pollution and changes in surrounding land use.

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3.2 STRUCTURE AND FUNCTIONS

Structural aspects Structural aspects Structural aspects Structural aspects Structural aspects
Components that make up the structural aspects of an ecosystem include:

- 1) Inorganic aspects – C, N, CO₂, H₂O.
- 2) Organic compounds – Protein, Carbohydrates, Lipids – link abiotic to biotic aspects.
- 3) Climatic regimes – Temperature, Moisture, Light & Topography.
- 4) Producers – Plants.
- 5) Macro consumers – Phagotrophs – Large animals.
- 6) Micro consumers – Saprotrophs, absorbers – fungi.

Functional aspects Functional aspects Functional aspects Functional aspects Functional aspects

- 1) Energy cycles.
- 2) Food chains.
- 3) Diversity-interlinkages between organisms.
- 4) Nutrient cycles-biogeochemical cycles.
- 5) Evolution.

Ecosystems

Since each ecosystem has a non-living and a living part that are linked to each other, one needs to look around us and observe this closely. This is an important aspect that is a vital part of our lives.

The non-living components of an ecosystem are the amount of water, the various inorganic substances and organic compounds, and climatic conditions such as rainfall and temperature, which depend on geographical conditions and location which is also related to the amount of sunlight. The living organisms in an ecosystem are inseparable from their habitat.

The living component of plant life ranges from extremely small bacteria, which live in air, water and soil, algae which live in fresh and salt water, to the terrestrial plants which range from grasses and herbs that grow after the monsoon every year, to the giant long-lived trees of the forest. The plants convert energy from sunlight into organic matter for their growth. They thus function as producers in the ecosystem. The living component of the animal world ranges from microscopic animals, to small insects and the larger animals such as fish, amphibia, reptiles, birds and mammals. Man is just one of the 1.8 million species of plants and animals that inhabit the earth.

3.3 PRODUCERS, CONSUMERS AND DECOMPOSERS

Every living organism is in some way dependent on other organisms. Plants are food for herbivorous animals which are in turn food for carnivorous animals. Thus there are different trophic levels in the ecosystem. Some organisms such as fungi live only on dead material and inorganic matter.

Plants are the 'producers in the ecosystem as they manufacture their food by using energy from the sun. In the forest these form communities of plant life. In the sea these include tiny algal forms to large seaweed. The herbivorous animals herbivorous animals herbivorous animals herbivorous animals herbivorous animals are primary consumers as they live on the producers. In a forest, these are the insects, amphibia, reptiles, birds and mammals. The herbivorous animals include for example hare, deer and elephants that live on plant life. They graze on grass or feed on the foliage from trees. In grasslands, there are herbivores such as the blackbuck that feed on grass. In the semiarid areas, there are species such as the chinkara or Indian gazelle. In the sea, there

Herbivores Nectarivores Frugivores Gramnivores are small fish that live on algae and other plants. At a higher tropic level, there are carnivorous carnivorous carnivorous carnivorous carnivorous animals animals animals animals animals, or secondary consumers, which live on herbivorous animals. In our forests, the carnivorous animals are tigers, leopards, jackals, foxes and small wild.

UNIT 4: Biodiversity

4.1 INTRODUCTION

The great variety of life on earth has provided for man's needs over thousands of years. This diversity of living creatures forms a support system which has been used by each civilization for its growth and development. Those that used this "bounty of nature" carefully and sustainably survived. Those that overused or misused it disintegrated. Science has attempted to classify and categorize the variability in nature for over a century. This has led to an understanding of its organization into communities of plants and animals. This information has helped in utilizing the earth's biological wealth for the benefit of humanity and has been integral to the process of 'development'. This includes better health care, better crops and the use of these life forms as raw material for industrial growth which has led to a higher standard of living for the developed world. However this has also produced the modern consumerist society, which has had a negative effect on the diversity of biological resources upon which it is based. The diversity of life on earth is so great that if we use it sustainably we can go on developing new products from biodiversity for many generations. This can only happen if we manage biodiversity as a precious resource and prevent the extinction of species.

Definition: 'Biological diversity' or biodiversity is that part of nature which includes the differences in genes among the individuals of a species, the variety and richness of all the plant and animal species at different scales in space, locally, in a region, in the country and the world, and various types of ecosystems, both terrestrial and aquatic, within a defined area.

What is biodiversity? Biological diversity deals with the degree of nature's variety in the biosphere. This variety can be observed at three levels; the genetic variability within a species, the variety of species within a community, and the organisation of species in an area into distinctive plant and animal communities constitutes ecosystem diversity.

4.1.1 Genetic diversity

Each member of any animal or plant species differs widely from other individuals in its genetic makeup because of the large number of combinations possible in the genes that give every individual specific characteristics. Thus, for example, each human being is very different from all others. This genetic variability is essential for a healthy breeding population of a species. If

the number of breeding individuals is reduced, the dissimilarity of genetic makeup is reduced and in-breeding occurs. Eventually this can lead to the extinction of the species. The diversity in wild species forms the 'gene pool' from which our crops and domestic animals have been developed over thousands of years. Today the variety of nature's bounty is being further harnessed by using wild relatives of crop plants to create new varieties of more productive crops and to breed better domestic animals. Modern biotechnology manipulates genes for developing better types of medicines and a variety of industrial products.

4.1.2 Species diversity

The number of species of plants and animals that are present in a region constitutes its species diversity. This diversity is seen both in natural ecosystems and in agricultural ecosystems. Some areas are richer in species than others. Natural undisturbed tropical forests have much greater species richness than plantations developed by the Forest Department for timber. Production.

A natural forest ecosystem provides a large number of non-wood products that local people depend on such as fruit, fuel wood, fodder, fiber, gum, resin and medicines. Timber plantations do not provide the large variety of goods that are essential for local consumption. In the long-term the economic sustainable returns from non-wood forest products is said to be greater than the returns from felling a forest for its timber. Thus the value of a natural forest, with all its species richness is much greater than a plantation.

VALUE OF BIODIVERSITY

Environmental services from species and ecosystems are essential at global, regional and local levels. Production of oxygen, reducing carbon dioxide, maintaining the water cycle, protecting soil are important services. The world now acknowledges that the loss of biodiversity contributes to global climatic changes. Forests are the main mechanism for the conversion of carbon dioxide into carbon and oxygen. The loss of forest cover, coupled with the increasing release of carbon dioxide and other gases through industrialization contributes to the 'greenhouse effect'. Global warming is melting ice caps, resulting in a rise in the sea level which will submerge the low lying areas in the world. It is causing major atmospheric changes, leading to increased temperatures, serious droughts in some areas and unexpected floods in other areas.

UNIT 5: Pollution

'We spray our elms, and the following spring, trees are silent of robin song, not because we sprayed the robins directly but because the poison traveled step by step through the now familiar elm-earthworm-robin cycle' – Rachael Carson This quotation appeared in Rachael Carson's book entitled Silent Spring. In the years following the publication of Silent Spring in 1962, the book has inspired controversy and has initiated a major change in thinking about the safety of using pesticides and other toxic chemicals.

5.1 DEFINITION

Pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings. Pollution when only short-term economic gains are made at the cost of the long-term ecological benefits for humanity. No natural phenomenon has led to greater ecological changes than have been made by mankind. During the last few decades we have contaminated our air, water and land on which life itself depends with a variety of waste products.

Pollutants include solid, liquid or gaseous substances present in greater than natural abundance produced due to human activity, which have a detrimental effect on our environment. The nature and concentration of a pollutant determines the severity of detrimental effects on human health. An average human requires about 12 kg of air each day, which is nearly 12 to 15 times greater than the amount of food we eat. Thus even a small concentration of pollutants in the air becomes more significant in comparison to the similar levels present in food. Pollutants that enter water have the ability to spread to distant places especially in the marine ecosystem.

From an ecological perspective pollutants can be classified as follows:

Degradable or non-persistent pollutants: These can be rapidly broken down by natural processes. Eg: domestic sewage, discarded vegetables, etc.

Slowly degradable or persistent pollutants: Pollutants that remain in the environment for many years in an unchanged condition and take decades or longer to degrade. Eg: DDT and most plastics.

Non-degradable pollutants: These cannot be degraded by natural processes. Once they are released into the environment they are difficult to eradicate and continue to accumulate. Eg: toxic elements like lead or mercury.

5.2 CAUSES, EFFECTS AND CONTROL MEASURES OF POLLUTION

5.2.1 Air Pollution

History of air pollution: The origin of air pollution on the earth can be traced from the times when man started using firewood as a means of cooking and heating. Hippocrates has mentioned air pollution in 400 BC. With the discovery and increasing use of coal, air pollution became more pronounced especially in urban areas. It was recognized as a problem 700 years ago in London in the form of smoke pollution, which prompted King Edward I to make the first antipollution law to restrict people from using coal for domestic heating in the year 1273. In the year 1300 another Act banning the use of coal was passed. Defying the law led to imposition of capital punishment. In spite of this air pollution became a serious problem in London during the industrial revolution due to the use of coal in industries. The earliest recorded major disaster was the 'London Smog' that occurred in 1952 that resulted in more than 4000 deaths due to the accumulation of air pollutants over the city for five days.

5.2.2 Water Pollution

Our liquid planet glows like a soft blue sapphire in the hard-edged darkness of space. There is nothing else like it in the solar system. It is because of water. – John Todd

Introduction: Water is the essential element that makes life on earth possible. Without water there would be no life. We usually take water for granted. It flows from our taps when they are turned on. Most of us are able to bathe when we want to, swim when we choose and water

Ambient air quality standards in India developed by the Central Pollution Control Board

Like good health we ignore water when we have it.

Although 71% of the earth's surface is covered by water only a tiny fraction of this water is available to us as fresh water. About 97% of the total water available on earth is found in oceans and is too salty for drinking or irrigation. The remaining 3% is fresh water. Of this 2.997% is locked in ice caps or glaciers. Thus only 0.003% of the earth's total volume of water is easily

available to us as soil moisture, groundwater, water vapour and water in lakes, streams, rivers and wetlands.

In short if the world's water supply were only 100 litres our usable supply of fresh water would be only about 0.003 litres (one-half teaspoon). This makes water a very precious resource. The future wars in our world may well be fought over water. By the middle of this century, almost twice as many people will be trying to share the same amount of fresh water the earth has today. As freshwater becomes more scarce access to water resources will be a major factor in determining the economic growth of several countries around the world.

UNIT 6: Social Issues and The Environment

6.1 FROM UNSUSTAINABLE TO SUSTAINABLE DEVELOPMENT

Until two decades ago the world looked at economic status alone as a measure of human development. Thus countries that were economically well developed and where people were relatively richer were called advanced nations while the rest where poverty was widespread and were economically backward were called developing countries. Most countries of North America and Europe which had become industrialized at an earlier stage have become economically more advanced. They not only exploited their own natural resources rapidly but also used the natural resources of developing countries to grow even larger economies. Thus the way development progressed, the rich countries got richer while the poor nations got poorer. However, even the developed world has begun to realise that their lives were being seriously affected by the environmental consequences of development based on economic growth alone. This form of development did not add to the quality of life as the environmental conditions had begun to deteriorate. By the 1970s most development specialists began to appreciate the fact that economic growth alone could not bring about a better way of life for people unless environmental conditions were improved. Development strategies in which only economic considerations were used, had begun to suffer from serious environmental problems due to air and water pollution, waste management, deforestation and a variety of other ill effects that seriously affected peoples' well being and health. There were also serious equity issues between the "haves and the have nots" in society, at the global and national levels. The disparity in the lifestyles between the rich and the poor was made worse by these unsustainable development strategies.

Many decades ago, Mahatma Gandhi envisioned a reformed village community based on sound environmental management. He stressed on the need for sanitation based on recycling human and animal manure and well-ventilated cottages built of recyclable material. He envisioned roads as being clean and free of dust. His main objective was to use village made goods instead of industrial products. All these principals are now considered part of sound long-term development. Gandhiji had designed a sustainable lifestyle for himself when these concepts were not a part of general thinking.

It was also realized that these were not simple issues. Indira Gandhi said in the Stockholm Conference in 1972 that poverty was the greatest polluter. This meant that while the super rich nations had serious environmental problems, the under-developed in Asia, Africa and South America had a different set of environmental problems linked to poverty. Developing countries were suffering the consequences of a rapidly expanding human population with all its

The current strategies of economic development are using up resources of the world so rapidly that our future generations, the young people of the world, would have serious environmental problems, much worse than those that we are facing at present. Thus current development strategies have come to be considered unsustainable for the world's long-term development. The newer concept of development has come to be known as "Sustainable Development". The nations of the world came to clearly understand these issues at the Rio Conference in 1992. Several documents were created for the United Nations Conference on Environment and Development (UNCED), which brought out the fact that environment and development were closely connected and that there was a need to 'care for the Earth'.

To ensure sustainable development, any activity that is expected to bring about economic growth must also consider its environmental impacts so that it is more consistent with long term growth and development. Many 'development projects', such as dams, mines, roads, industries and tourism development, have severe environmental consequences that must be studied before they are even begun. Thus for every project, in a strategy that looks at sustainable development, there must be a scientifically and honestly done EIA, without which the project must not be cleared. Large dams, major highways, mining, industry, etc. can seriously damage ecosystems that support the ecological health of a region. Forests are essential for maintaining renewable resources, reducing carbon dioxide levels and maintaining oxygen levels in the earth's atmosphere. Their loss impairs future human development. Loss of forests depletes biodiversity which has to be preserved to maintain life on earth. Major heavy industries if not planned carefully lead to environmental degradation due to air and water pollution and generate enormous quantities of waste that lead to long term environmental hazards. Toxic and Nuclear wastes can become serious economic problems as getting rid of them is extremely costly. Thus the economic benefits of a project must be weighed against the possible environmental costs before a project is permitted.

Social Issues and The Environment

We as citizens of our Nation, and increasingly as citizens of one common future at the global level, must constantly monitor the pattern of development. If we see that a development project or an industry is leading to serious environmental problems, it is our duty to bring this to the attention of authorities such as the local administration, the Forest Department or the Pollution Control Board, to look into the issue. Further if new development projects are being planned in and around the place where we live it is our duty to see that this is brought about in accordance with environmental safeguards. While we all need to think globally, we need to act locally. We have to see to it that we change development from its present mandate of rapid economic growth without a thought for future ecological integrity, to a more sustainable ecologically appropriate strategy.

If new projects of a large size are to be passed Government has made it compulsory to publish the summary report of the Environmental Impact Assessment (EIA) and conduct a 'Public Hearing'. It is essential that all of us as responsible citizens read, evaluate and respond to such public hearings held in our area and make comments on the possible impacts of the project. In many situations there are proponents of the project who only look at their own rapid economic gains. It is for citizens as concerned individuals and groups to counter these vested interests so that our environment is not degraded further. Life has to be made more livable for all. We cannot

support the economic growth of one sector of society while we permit environmental degradation to destroy the lives of the less fortunate.

6.2 URBAN PROBLEMS RELATED TO ENERGY

Urban centers use enormous quantities of energy. In the past, urban housing required relatively smaller amounts of energy than we use at present. Traditional housing in India required very little temperature adjustments as the materials used, such as wood and bricks handled temperature changes better than the current concrete, glass and steel of ultra modern buildings.

Embodied energy Materials like iron, glass, aluminium, steel, cement, marble and burnt bricks, which are used in urban housing, are very energy intensive. The process of extraction, refinement, fabrication and delivery are all energy consuming and add to pollution of earth, air and water. This energy consumed in the process is called embodied energy.

Until the 1950s many urban kitchens were based on fuelwood or charcoal. This was possible and practical when homes had chimneys and kitchens were isolated from the rest of the house. Smoke became a problem once this changed to apartment blocks. Kerosene thus became a popular urban fuel. This changed to electrical energy and increasingly to natural gas by the 1970s in most parts of urban India. Urban centers in hot climates need energy for cooling. The early systems of fans changed into air-conditioning, which consumes enormous quantities of energy. New buildings in our country have taken to using large areas covered by glass. While in cold climates this uses the green house effect to trap the warmth of the sun inside, in our hot climate this adds several degrees to the temperature inside. Thus it requires even more energy to run large central air conditioning units. High rise buildings in urban centers also depend on energy to operate lifts and an enormous number of lights.

UNIT 7: Human Population and the Environment

7.1 POPULATION GROWTH, VARIATION AMONG NATIONS

Our global human population, 6 billion at present, will cross the 7 billion mark by 2015. The needs of this huge number of human beings cannot be supported by the Earth's natural resources, without degrading the quality of human life.

In the near future, fossil fuel from oil fields will run dry. It will be impossible to meet the demands for food from existing agro systems. Pastures will be overgrazed by domestic animals and industrial growth will create ever-greater problems due to pollution of soil, water and air. Seas will not have enough fish. Larger ozone holes will develop due to the discharge of industrial chemicals into the atmosphere, which will affect human health. Global warming due to industrial gases will lead to a rise in sea levels and flood all low-lying areas, submerging coastal agriculture as well as towns and cities. Water 'famines' due to the depletion of fresh water, will create unrest and eventually make countries go to war. The control over regional biological diversity, which is vital for producing new medicinal and industrial products, will lead to grave economic conflicts between biotechnologically advanced nations and the bio-rich countries. Degradation of ecosystems will lead to extinction of thousands of species, destabilizing natural ecosystems of great value. These are only some of the environmental problems related to an increasing human population and more intensive use of resources that we are likely to face in future. These effects can be averted by creating a mass environmental awareness movement that will bring about a change in people's way of life.

In other regions famines due to drought have become more frequent. Present development strategies have not been able to successfully address these problems related to hunger and malnutrition. On the other hand, only 15% of the world's population in the developed world is earning 79% of income! Thus the disparity in the extent of per capita resources that are used by people who live in a 'developed' country as against those who live in a 'developing' country is extremely large. Similarly, the disparity between the rich and the poor in India is also growing. The increasing pressures on resources place great demands on the in-built buffering action of nature that has a certain ability to maintain a balance in our environment. However, current development strategies that essentially lead to short-term gains have led to a breakdown of our Earth's ability to replenish the resources on which we depend.

7.1.1 Global population growth

The world population is growing by more than 90 million per year, of which 93% is in developing countries. This will essentially prevent their further economic 'development'. In the past, population growth was a gradual phenomenon and the Earth's ability to replenish resources was capable of adjusting to this increase. In the recent past, the escalation in growth of human numbers has become a major cause of our environmental problems.

Present projections show that if our population growth is controlled, it will still grow to 7.27 billion by 2015. However, if no action is taken it will become a staggering 7.92 billion.

Human population growth increased from: 1 to 2 billion, in 123 years. 2 to 3 billion, in 33 years. Human Population and the Environment 3 to 4 billion, in 14 years. 4 to 5 billion, in 13 years. 5 to 6 billion, in 11 years.

It is not the census figures alone that need to be stressed, but an appreciation of the impact on natural resources of the rapid escalation in the rate of increase of human population in the recent past. The extent of this depletion is further increased by affluent societies that consume per capita more energy and resources, than less fortunate people. This is of great relevance for developing a new ethic for a more equitable distribution of resources.

In the first half of the 1900s human numbers were growing rapidly in most developing countries such as India and China. In some African countries the growth was also significant. In contrast, in the developed world population growth had slowed down. It was appreciated that the global growth rate was depleting the Earth's resources and was a direct impediment to human development. Several environmental ill-effects were linked with the increasing population of the developing world. Poverty alleviation programs failed, as whatever was done was never enough as more and more people had to be supported on Earth's limited resources. In rural areas population growth led to increased fragmentation of farm land and unemployment. In the urban sector it led to inadequate housing and an increasing level of air pollution from traffic, water pollution from sewage, and an inability to handle solid waste. By the 1970s most countries in the developing world had realized that if they had to develop their economics and improve the lives of their citizens they would have to curtail population growth.

Though population growth shows a general global decline, there are variations in the rate of decline in different countries. By the 1990s the growth rate was decreasing in most countries such as China and India. The decline in the 90s was greatest in India. However, fertility continues to remain high in sub Saharan African countries.

There are cultural, economic, political and demographic reasons that explain the differences in the rate of population control in different countries. It also varies in different parts of certain countries and is linked with community and/ or religious thinking. Lack of Government initiatives for Family Welfare Program and a limited access to a full range of contraceptive measures are serious impediments to limiting population growth in several countries.

7.2 POPULATION EXPLOSION – FAMILY WELFARE PROGRAM

In response to our phenomenal population growth, India seriously took up an effective Family Planning Program which was renamed the Family Welfare Program. Slogans such as ‘ Hum do hamare do ’ indicated that each family should not have more than two children. It however has taken several decades to become effective.

At the global level by the year 2000, 600 million, or 57% of women in the reproductive age group, were using some method of contraception. However the use of contraceptive measures is higher in developed countries – 68%, and lowers in developing countries - 55%. Female sterilization is the most popular method of contraception used in developing countries at present. This is followed by the use of oral contraceptive pills and, intrauterine devices for women, and the use of condoms for men. India and China have been using permanent sterilization more effectively than many other countries in the developing world. The best decision for the method used by a couple depends on a choice that they make for themselves. This must be based on good advice from doctors or trained social workers who can suggest the full range of methods available for them to choose from.

Informing the public about the various contraceptive measures that are available is of primary importance. This must be done actively by Government Agencies such as Health and Family Welfare, as well as Education and Extension workers. It is of great importance for policy makers and elected representatives of the people – Ministers, MPs, MLAs at Central and State levels – to understand the great and urgent need to support Family Welfare. The media must keep people informed about the need to limit family size and the ill effects of a growing population on the world's resources. The decision to limit family size depends on a couple's background and education. This is related to Government Policy, the effectiveness of Family Welfare Programs, the educational level, and information levels in mass communication. Free access to Family Welfare information provided through the Health Care System, is in some cases unfortunately counteracted by cultural attitudes. Frequently misinformation and inadequate information are reasons why a family does not go in for limiting its size. The greatest challenge the world now faces is how to supply its exploding human population with the resources it needs. It is evident that without controlling human numbers, the Earth's resources will be rapidly exhausted. In addition economically advanced countries and rich people in poorer countries use up more resources than they need.

Google Classroom Link for EVS: <https://classroom.google.com/u/1/c/MTE4NzU3MDE2MjU5>