

**VEER NARMAD SOUTH GUJARAT UNIVERSITY
SURAT**

**B. Sc. ENVIRONMENTAL SCIENCE
T. Y. B. Sc.
Semester - V and VI
SYLLABUS**

With Effect from 2016-17

**VEER NARMAD SOUTH GUJARAT UNIVERSITY
SURAT**

B. Sc. ENVIRONMENTAL SCIENCE

Semester - V

SYLLABUS

With Effect from 2016-17

Semester V
CORE - I
PAPER – I

Env 501 : ENVIRONMENTAL SCIENCE – XI
WATER POLLUTION & TREATMENT

OBJECTIVES: *The paper intends to deal with sources of water pollution & economic solutions to water resource problems, types of water pollutants, their sources and fates, health risks associated with water supplies, the criteria and methods to improve water quality.*

	Total Hours: 30
UNIT 1 Ground and surface water pollution and treatment	06
1.1 Sources of ground water pollution and its effect	
1.2 Sources of surface water pollution and its effect	
1.3 Drinking water treatment	
UNIT 2 Industrial wastes and treatment processes	08
2.1 Characteristics of industrial waste	
2.2 Types of industrial waste	
2.3 Principles of industrial waste treatment	
2.4 Protection of surface water from pollution with industrial sewage	
2.5 Treatment and disposal of industrial sewage	
2.6 Treatment of wastes or effluents with organic impurities	
2.7 Treatment of wastes or effluents with Inorganic impurities	
UNIT 3 Sewage and sewage treatment	08
Municipal waste water	
3.1 Sewage & its composition	
3.2 Domestic sewage treatment	
3.3 Purpose of sewage treatment	
3.4 Methods of sewage treatment	
3.5 Types: aerobic oxidation plant & anaerobic oxidation plant	
3.6 Miscellaneous methods of sewage treatment	
UNIT 4 Agricultural pollution	08
4.1 Source of agricultural pollution	
4.2 Farm wastes	
4.3 Pesticides pollution	
4.4 Sources of pesticides pollutants in water	
4.5 Effect of pesticides on Man, animals, birds & Aquatic biota	
4.6 Methods to minimize pesticides pollution	
4.7 Future strategy for pesticide use	
4.8 Fertilizers & Bio fertilizers	
4.9 Effects of Fertilizers on Man, Animals & plants	

Books:

1. Water Supply & Sanitary Engineering - G.S.Birdie & J. S.Birdie, 61993, Dhanpat Rai Sons Publications.
2. Environmental Chemistry- A. K. De, 7th Edition, 2015, New Age International Publisher.
3. Environmental Chemistry - H. Kaur, 8th Edition, 2014, Pragati Prakashan
4. Environmental Chemistry - S. E. Manahan, 9th Edition, 2010, CRC Press.
5. Textbook of Environmental chemistry and pollution control- Dara S.S., 1st Edition, 1993, S.Chand & Co.
6. Advanced Environmental Chemistry- Naz Shiv, 1st Edition, 2014, Anmol Publication
7. Handbook of Environmental Health and Safety - principle and practices (Vol. II): H. Koren; 4th Edition, 2003, Lewis Publishers
8. Environmental Chemistry- B.K. Sharma, 12th Edition, 2011, Krishna Prakashan.

PRACTICALS – XI

1. Determination of Turbidity and Conductivity of given water sample
2. To determine the temporary and permanent hardness of water.
3. Analysis of DO ,BOD and COD in Waste Water Sample
4. Analysis of Fluoride in Ground Water and Potable Water.

Semester V
CORE - I
PAPER – II

Env 502 : ENVIRONMENTAL SCIENCE – XII
AIR POLLUTION AND CONTROL

OBJECTIVES: *The paper intends to deal with air pollution sources, effects, control, factors affecting air pollution, basics of air quality, standards, sampling and analysis of some pollutants.*

		Total Hours: 30
UNIT 1	Sources and factors affecting air pollution	04
1.8	Introduction of air pollution	
1.9	Sources of air pollution: primary, secondary pollutants and particulate matter, natural and man-made sources	
1.3	Factors affecting air pollution: wind direction, temperature inversion, mixing height, precipitation, humidity, solar radiation	
UNIT 2	Causes and effects of air pollution	10
2.1	Causes and effects of Global warming, Acid rain, Ozone depletion, Smog, El Nino and La Nina	
2.2	Effects of air pollution on biological system: animals, plants, humans	
2.3	Effects of air pollution on non biological systems: materials	
2.4	Air pollution disasters at: Meuse valley, Donora, London, New york, Los Angeles, Tokyo	
2.5	Air pollution accidents at: Poza Rico (Mexico), Seveso (Italy), Bhopal (India), Chernobyl (Ukraine)	
UNIT 3	Sampling and Analysis of pollutants	08
3.1	Basics of ambient air quality standards and emission standards	
3.2	Sampling of pollutants: particulates, gases and vapor	
3.3	Analysis of pollutants	
3.3.1	Measurement of SPM, RSPM	
3.3.2	SO ₂ , NO ₂ , CO	
3.3.3	Total oxidants	
3.3.4	Smoke density	

UNIT 4 Control of air pollution 08

- 4.1 Particulate control at source: Raw material change, Process modification, Equipment modification
- 4.2 Particulate Control equipments: Settling chambers, Cyclones, Electrostatic precipitators, Scrubbers
- 4.3 Control of gaseous pollutants: Adsorption, Absorption, Combustion, Condensation
- 4.4 Control measures of Global warming, Acid rain, Ozone depletion and Smog

Books:

- 3. Air Pollution - M. N. Rao and H. V. N. Rao, 26th Edition, 2007, Tata McGraw Hills
- 4. An introduction to air pollution - R. K. Trivedy, P. K. Goel, 1st Edition, 2003, ABD Publishers
- 5. Textbook Of Air Pollution And Its Control – S. C. Bhatia, 1st Edition, 2007, Atlantic Publishers
- 6. Air Pollution Control Engineering – Noel De Nevers, 2nd Edition, 2000, McGraw Hill
- 7. Environmental pollution and control in chemical industries - S. C. Bhatia, 2nd Edition, 2014, Khanna Publishers.
- 8. Methods of Air Sampling and Analysis- James P. Lodge, JR., 3rd Edition, 2016, CRC Press
- 9. Air Pollution Engineering Manual – Wayne T. David, 2nd Edition, 2000, John Wiley and Sons

PRACTICALS – XII

- 1. To study principle, components and working operation of stack monitoring kit.
- 2. Determination of NO_x of ambient air.
- 3. Determination of SO_x of ambient air.
- 4. To determine RSPM and SPM of ambient air.

Semester V
CORE - I
PAPER – III

Env 503 : ENVIRONMENTAL SCIENCE – XIII
SOLID AND HAZARDOUS WASTE POLLUTION & MANAGEMENT

OBJECTIVES: *The paper intends to deal with municipal solid waste, hazardous waste, biomedical and E-waste sources, classification, properties, effects, waste management, disposal, treatment, recycling and reuse.*

Total Hours: 30

UNIT 1	Solid Waste	08
1.1	Introduction : source and classification	
1.2	Causes and effects	
1.3	Control measures:	
1.3.1	Collection	
1.3.2	Disposal	
1.3.3	Recycling, recovery and reuse of solid waste	
1.3.4	Waste utilization and applications	
UNIT 2	Municipal Solid Waste	07
2.1	Introduction : source and type based classification	
2.2	Composition of MSW, generation and segregation	
2.3	Characteristics/properties of MSW: physical, chemical and biological	
2.4	Transformation of MSW: physical, chemical and biological	
UNIT 3	Hazardous Waste	09
3.1	Introduction : Nature and sources	
3.2	Identification and listed hazardous waste	
3.3	Characteristics , classification and effects	
3.4	Hazardous waste management: generation, storage and collection, transfer and transport, processing, disposal	
3.5	Hazardous waste treatment: physical, chemical, thermal and biological	
3.6	Pollution prevention and waste minimization	

UNIT 4 Biomedical & E-Waste

06

- 4.1 Biomedical waste : Introduction
- 4.2 Sources and categories
- 4.3 Management rules and technologies
- 4.4 E-Waste: Introduction
- 4.5 Sources and effects
- 4.6 E-Waste management- treatment and disposal

Books:

- 10. Integrated solid waste management : Engineering principles and issues - George Tchobanoglous, Hilary Theisen, Samuel A. Vigil, 2nd Edition , 2014, McGraw Hill Education
- 11. Handbook of solid waste management - Frank Kreith, 1st Edition , 1994, McGraw Hill Inc
- 12. Management of municipal solid waste - T. V. Ramchandra, 5th Reprint, 2014, TERI Press
- 13. Environmental Chemistry - H. Kaur, 8th Edition , 2014, Pragati Prakashan
- 14. Environmental Chemistry- B.K Sharma, 9th Edition, 2005, Krishna Prakashan
- 15. Environmental studies - S.K. Dhameja, 3rd Edition,2007, Kataria Publishers
- 16. Environmental Chemistry – S.C. Bhatia,1st Ed ,2002, Reprint: 2013, CBS Publishers

PRACTICAL – XIII

- 1. To determine nitrogen content of solid waste.
- 2. To determine phosphorous content of solid waste.
- 3. To determine potassium content of solid waste.
- 4. To determine carbon content of solid waste.

Semester V
CORE - I
PAPER – IV

Env 504 : ENVIRONMENTAL SCIENCE – XIV
ENVIRONMENTAL MICROBIOLOGY

OBJECTIVES: *The paper deal with microbial population which presents in air, soil and water which are playing role in pro-pollution and anti-pollution activity .*

	Total Hours: 30
UNIT 1: Microbial Ecology	09
1.1 Microbial ecology and ecosystem: introduction, characteristics and methodology	
1.2 Population interactions: different types of positive and symbiotic	
1.3 Neutral and negative interactions	
1.4 Microbiology of rumen ecosystem	
UNIT 2: Aeromicrobiology	06
2.1 Introduction and importance of airborne pathogen, toxins, aerosols, natural aerosols	
2.2 Aeromicrobiological pathway and microbial survival in air	
2.3 Extra and intramural aeromicrobiology	
2.4 Bioaerosol control and biosafety in the laboratory	
UNIT 3: Soil Microbiology	08
3.1 Physical and chemical properties of soil	
3.2 Microorganisms in soil	
3.3 Microbiological analysis of soil	
3.4 Rhizosphere and phyllosphere microflora	
3.5 Soil microorganisms associations with vascular plants	
3.6 Nitrogen fixation	
UNIT 4: Water Microbiology	07
4.1 Introduction	
4.2 Microbiological standards and analysis for drinking water	
4.3 Microbiological standards and analysis for sanitary water.	
4.4 Role of indicator organisms in water	

Books:

1. Prescott's Microbiology – J. Wiley, L. Sherwood, C. Woolverton, 8th Edition, 2007, McGraw-Hill.
2. Microbiology – M. J. Pelczar and E. C. S. Chan, 5th Edition, 1998, Tata-McGraw-Hill
3. Environmental microbiology - R. M. Maier, 2nd Edition, 2008, Elsevier.
4. Soil Microbiology – N. S. Subba Rao, 4th Edition, 1999, Oxford & IBH.
5. Microbiology: Fundamentals and Applications – S. S. Purohit, 7th Edition, 2007, Agrobios
6. Microbiology: An Introduction – G. J. Tortora and B. R. Funke, 9th Edition, 2006, Benjamin Cummings.

PRACTICAL XIV

1. Assessment of air-solid settling plate technique.
2. (A) Isolation of nonsymbiotic nitrogen fixing aerobic bacteria- *Azotobacter* spp.
(B) Isolation of nonsymbiotic nitrogen fixing anaerobic bacteria- *Clostridium* spp.
(C) Isolation of symbiotic nitrogen fixing bacteria *Rhizobium* spp. from root nodules of legume plants
3. Bacteriological analysis of water. (quantitative, presence-absence test, detection & enumerations of C.F.)
4. Study of faecal indicator bacteria (*Enterococcus faecalis*) by membrane filter technique in water. (1 biochemical test)

Semester V
CORE - I
PAPER - V
Env 505 : ENVIRONMENTAL SCIENCE – XV
BIODIVERSITY AND RECENT DEVELOPMENT

OBJECTIVES: *This paper intends to deal with basic concepts and importance of biodiversity its species and speciation molecular tools for biodiversity studies and recent status of biodiversity.*

Total Hours:

	30
UNIT 1:	Biodiversity: Basic concepts and importance
	08
1.5	Introduction to biodiversity
1.6	Genetic, ecological and physical biodiversity
1.7	Components of biodiversity
1.8	Biodiversity and evolution
1.9	Magnitude of biodiversity
1.10	<i>Ex situ</i> and <i>In situ</i> conservation
UNIT 2:	Species and Speciation
	08
2.1	Taxonomic hierarchy and concept of species
2.5	Speciation and its types
2.6	Species diversified
2.7	Impact of climate change and global warming on speciation
2.8	Overexploitation of species
2.9	Dodo (<i>Raphus cuullatus</i>) history
2.10	Geographical variation and extinction of speciation
2.11	Anagenesis and Cladogenesis
UNIT 3:	Molecular tools for diversity studies
	07
	Principle and Applications of
3.1	DNA barcoding
3.7	Restriction Fragment Length Polymorphism (RFLP)
3.8	Random Amplified Polymorphic DNA (RAPD)
3.9	Amplified Fragment Length Polymorphism (AFLP)
3.10	Simple Sequence Repeats (SSR)
3.11	Denaturing Gradient Gel electrophoresis (DGGE)
3.12	Inter Simple Sequence Repeats (ISSR)
3.13	Importance and applications of molecular markers in biodiversity studies

UNIT 4: Recent biodiversity status

07

- 4.5 Biodiversity values in food, agriculture, medicine and industry
- 4.6 Biodiversity threatened - Extinction causes
- 4.3 Case studies - Destruction of forests, exotic species
- 4.4 Concept of threatened species and their reasons, IUCN Red List
- 4.5 Threatened species - Mammals, reptiles, birds, plants and seaweeds
- 4.6 Biodiversity hotspots
- 4.7 Importance, awareness and goals of biodiversity conservation
- 4.8 Biodiversity- Future aspects

Books:

1. Biodiversity: The abundance of life - Jenny Chapman and Michael Roberts, 1st Edition, 1997, Cambridge university Press.
2. An advanced textbook on biodiversity: Principle and Practice – K. V. Krishnamurthy, 2nd Edition, 2009, Oxford and IBH India Publishing, New Delhi.
3. Biodiversity and its conservation in India- S. S. Negi, 1st Edition, 1993, Indus publishing, New Delhi.
4. Introduction to biodiversity – D. K. Belsare, 1st Edition, 2007, APH Publishing Corporation, New Delhi.
5. Environmental Biotechnology – M. H. Fulekar, 1st Edition, 2010, Science Publishers.
6. Principles of gene manipulation – S. B. Primrose., Richard Twyman and Bob Old, 6th Edition, 2001, Blackwell Publishing.
7. Textbook of biodiversity – K. V. Krishnamurthy, 1st Edition, 2003, Science Publishers.

PRACTICAL – XV

1. Isolation of Total DNA from bacteria.
2. Isolation of Total DNA from plants.
3. Isolation of Total DNA from eukaryotic cell.
4. Study of biological hotspots of South Gujarat, India.

Semester V
CORE - I
PAPER – VI

Env 506: ENVIRONMENTAL SCIENCE - XVI
ENVIRONMENT AND HEALTH

OBJECTIVES: *The paper intends to deal with public health concerned with aspects of the natural and built environment that may affect human health.*

		Total Hours: 30
UNIT 1	Environment and human health	08
1.10	Human systems	
1.11	Principles of communicable disease	
1.12	Health implications of new technology	
1.13	Epidemiological principles	
UNIT 2	Occupational environment	06
2.1	Introduction	
2.2	Interrelated phases of occupational health and safety	
2.3	Occupational health control	
2.4	Occupational health and safety program	
UNIT 3	Health and diseases	07
3.1	Water borne disease	
3.2	Air borne disease	
3.3	Vector borne disease	
3.4	Food borne disease	
UNIT 4	Urbanization and health	09
4.1	Pollution and health	
4.1.1	Urbanization	
4.1.2	Industrialization	
4.2	Disaster and health	
4.2.1	Natural disaster	
4.2.2	Manmade disaster	

Books:

1. Environmental Health Vol. 1 – H. Koren and M. Bisesi, 4th Edition, 2003, Lewis Publishers.
2. Environmental Health Vol. – H. Koren and M. Bisesi, 4th Edition, 2003, Lewis Publishers.
3. Environmental Chemistry – A. K. De, 7th Edition, 2015, New Age International Publishers.

PRACTICAL - XVI

1. To isolate and identify microbial organisms in air.
2. To determine microbial organisms in water.
3. To determine physical properties of water.
4. To determine chlorine dose for water supply.

Semester V
PAPER –IDS

ENVIRONMENTAL MANAGEMENT AND LAW

OBJECTIVES: *The paper deals with law, policies, control and management of air pollution, water pollution, solid & hazardous waste and forest.*

Total Hours: 30

UNIT-1 Indian law and policies for environment-I(Pollution)	07
1.1 Introduction	
1.2 Water prevention and control of pollution act, 1974, 1981	
1.3 Air prevention and control of pollution act, 1981	
1.4 Environment protection act, 1986	
1.5 Factories act, 1948	
UNIT-2 Indian law and policies for environment-II (Forest)	08
2.1 Indian Forest Act, 1927	
2.2 Indian Wildlife (Protection) Act, 1972	
2.3 Forest Conservation Act, 1980	
2.4 Biodiversity Act, 2002	
2.5 National Green Tribunal Act, 2010	
UNIT-3 Indian law and policies for environment-III (Management)	08
3.1 Municipal Solid Waste (Management and Handling Rules), 2000	
3.2 Hazardous waste management handling and trans-boundary movement, 2008	
3.3 Bio-Medical Waste (Management & Handling) Rules,1998	
3.4 Recycled Plastics Manufacture and Usage Rules, 1999	
3.5 E-waste Management and Handling Rules, 2011	
3.6 Noise Pollution (Regulation and Control) Rules, 2000	
UNIT-4 Environment Audit and Environment Impact Assessment	07
4.1 Introduction to EIA and EA	
4.2 Methodology of EIA and limitation	
4.3 Environmental Risk Assessment	
4.4 Audit Methodology	
4.5 EA report	
4.6 Benefits of Environmental Audit	

Books:

1. Handbook of Environmental Laws – P. B. Sahasranaman, 2nd Edition, 2012, Oxford University Press.
2. Environmental Law Case Book – P. Leelakrishnan, 2nd Edition, 2006, Lexis Nexis.
3. Environmental Protection and the Law – A. Gadekar and N. Solanki, 1st Edition, 2015, A.P.H. Publishing Corporation.
4. Environmental Regulation, Law, Science and Policy – R. V. Percival, 1st Edition, 1992, Little Brown & Comp.