GONDWANA UNIVERSITY

GADCHIROLI

National Education Policy 2020

FACULTY OF SCIENCE AND TECHNOLOGY

Syllabus B.Sc. Semester I

Program: FYUGP

Major Course: Environmental Science

With effect from 2026-2027

Bachelor of Science

(Honors/Research)

ENVIRONMENTAL SCIENCE- MAJOR

Environment science deals with the study and processes in water, air, land, soil and organisms which leads to pollute or degrade environment. It helps us for establishing standard for safe, clean and healthy natural ecosystem. It also deals with important issues like safe and clean drinking water, hygienic living conditions and clean and fresh air, fertility of land, healthy food and development.

Programs Outcomes:

Knowledge

Students can learn about environmental issues at local, regional, and global scales.

Skills

Students can learn how to use modern instruments and analytical techniques for environmental analysis. They can also learn to apply scientific methods and quantitative techniques to understand environmental systems.

Awareness

Students can become more aware of environmental concerns, climate change, and related mitigation strategies. They can also learn to appreciate the ethical, cross-cultural, and historical context of environmental issues.

Decision-making

Students can learn how to apply their knowledge to make efficient environmental decisions, management, and sustainable development.

B.Sc. Semester I

TEACHING AND EXAMINATION SCHEME

Gondwana University, Gadchiroli

NEP 2020 U.G.

PROGRAMME: SESSION 2026-2027

GUGSTUGENVS

Faculty of Science and Technology

Programme Name - B.Sc. Sem. I (Environmental Science)

General Instructions

1. Theory examination for all Semesters will be at university level

2. The examination of Semester I shall comprise of theory papers of 2 hours duration of 40 marks each. Ten marks will be allotted for internal assessment for each theory paper.

3. The examination of Semester II shall comprise of theory papers of 2 hours duration of 40 marks each. Ten marks will be allotted for internal assessment for each theory paper.

4. Question paper will consist of five questions and each question will be of 8 marks.

5. Five questions will be based on four units with internal choice.

6. Fifth question will be compulsory with questions from each of the four units having equal weightage and there will be no internal choice.

7. Practical examination will be of 4 hours duration and separately for each semester having 30 marks each.

8. The marks will be given for all examinations and they will be converted into grade points. The final grade card will have marks, credits, grades, grade points, SGPA and CGPA.

Distribution of Practical Marks (Semester I and II each)

1 Two experiments: **20 marks (10 marks each)**

2 Certified practical record book: **04 marks**

3 Certified tour report/field diary: **03 marks**

4 Viva-voce: **03 marks**

Total = 30 marks

Gondwana University, Gadchiroli
NEP 2020 U.G. PROGRAMME SESSION 2026-27
Faculty of Science and Technology
Programme Name-B.Sc. Sem. I (Environmental Science) (Level 4.5) Examination Scheme & Basket

Sr. No.	Course Category	Subject Name		Subject code	Total Credit	Teaching Scheme (Hrs)			Examination Scheme									Total Marks
									Theory					Practical				
						Theory	Practical	Total Hrs.	UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark	Min. Passing	
1	Core Subject	Select any Three core group subject from Annesure-I	i) Subject- I - Introduction to Environmental Science	STUG01ENVS001	02	02	-	02	40	10	50	20	03	-	-	-	-	50
			ii) Subject - II		02	02	-	02	40	10	50	20	03	-	-	-	-	50
			iii) Subject - III		02	02	-	02	40	10	50	20	03	-	-	-	-	50
			i) Practical Based on Subject –I Introduction to Environmental Science Practical	STUG01ENVS002	02	-	04	04	-	-	-	-	-	30	20	50	25	50
			ii) Practical Based on Subject –II		02	-	04	04	-	-	-	-	-	30	20	50	25	50
			iii) Practical Based on Subject –III		02	-	04	04	-	-	-	-	-	30	20	50	25	50
2	SEC	Environmental Monitoring and Analysis (Any one from 3 subjects-Annexure-II)		STUG01ENVS003	02	-	04	04	-	-	-	-	-	30	20	50	25	50
3	VEC	Audit Course (College level exam) Annexure-III)			02	02	-	02	-	50	50	20	-	-	-	-	-	50
4	AEC	English/Marathi/Hindi/Bengali/Pali/ Supplementary English, Annexure-IV			02	02	-	02	40	10	50	20	02	-	-	-	-	50
5	CC	NCC/NSS/Yoga/Sports (Any One) (Collage level Exam)			02	-	04	04	-	-	-	-	-	-	50	50	25	50
6	IKS (Generic)	Indian Knowledge System- Generic			02	02	-	02	40	10	50	20	02	-	-	-	-	50
Total					22	12	20	32	200	100	300	120	13	120	130	250	125	550

B.Sc. Part I SEM I
CORE GROUP SUBJECT- I
STUG01ENVS001
Introduction to Environmental Science

Course objectives

The objective of an environmental science introduction course is to provide learners with a basic understanding of the concepts and principles of environmental sciences as well as a foundational knowledge of earth, hydrosphere, and atmospheric sciences.

Unit I: Basics of Environmental Science

1. Atoms and Molecules: Origin of the Universe. The three era – radiation, matter and life era. Nucleosynthesis. Life cycle of a star. Distribution of elements. Big bang theory. Solar system. Aura and Meteorite.

2. Earth: Formation of the earth. Structure of the earth. Composition of crust. Mantle, core and earth as a whole. Differentiation of elements. Origin of life. Evolution of human being. Earth and its special features. Evolutions of India.

3. Basics of Environmental Science: Definition, History of Environmental science: Conservation and environmentalism. Key Concepts in Environmental Science, General principles. Components: Atmospheric sciences, Ecology, Environmental chemistry, Geosciences, Theoretical and Applied aspects of Environmental Science. Scope of Environmental Science.

Unit II: Atmospheric Science

1. Atmosphere: Segments of total environment. Structure of atmosphere on the basis of (i) Composition (ii) Temperature (iii) Pressure. Modern view regarding the structure of atmosphere. Radiation balance. Lapse rate and temperature inversion. Chemical species and particulates in the atmosphere.

2. Climatology: Definition, Aims and Objectives. Difference between weather and climate. Condensation. Forms of condensation. Precipitation. Forms of precipitation. Fog: a simplified classification. Clouds and its classification.

3. Meteorology: Definition. Primary meteorological parameters and their measurement: temperature, wind direction and speed. Secondary meteorological parameters and their measurement: humidity, precipitation, pressure and solar radiation. Weather forecasting: methods, types, role of satellite in weather forecasting.

Unit III: Hydrosphere

1. Hydrological Cycle: Processes involved and their complex interactions. Salient features of major water compartment: ocean, glaciers, ice and snow, groundwater, river and streams, lakes and ponds.

2. Fresh Water Environment: Fresh water resources of India. Fresh water requirement of India. Lentic and Lotic environment with their characteristic features. Stratification: thermal, oxygen and other nutrients.

3. Marine Environment: Zonation. Physical factors: temperature, light and pressure. Chemical Factors: oxygen, carbon dioxide and hydrogen sulphide, salinity. El Niño and La Niña phenomenon.

Unit IV: Lithosphere

1. Petrology: Rocks in earth's crust. Types of rocks. Igneous, Sedimentary and Metamorphic: Formation. Examples and characteristics features.

2. Pedology: Definition. Weathering: Physical, Chemical, Biological. Soil forming processes. Soil profile. Major soil types of India and Maharashtra. Physical properties of soil: texture, density, porosity, temperature, air and water. Chemical Properties of soil: Cation exchange capacity. Acidic soil and basic soil.

3. Mineralogy: Importance of minerals. Important minerals in India. Formation of mineral deposits. Consequences of over exploitation of mineral resources. Conservation of mineral resources.

References

1. Environmental Science –W. Cunningham and Saigo, McGraw Hill, New York.
2. A textbook of environment –Agrawal, Mcmillion publication, Mumbai
3. A textbook of geology –Purbeen Singh.
4. Climatology – D.S. Lal, Sharda Pustak Bhawan, Allahbad, 2003.
5. Environmental Chemistry – S.S. Dara, S. Chand and Company, New Delhi 2002.
6. Environmental Chemistry- B.K. Sharma, Goel Publication, Meerut.
7. Air Pollution –M.N. Rao, Tata McGraw Hill Publishing Company limited, New Delhi,
8. Air Pollution –A .C. Stern
9. Environmental Problems and solution- Asthana, S. Chand and company, New Delhi.
10. Environmental Science-S.C. Santra, New Central Book Agency private Limited,
11. 11.Fundamental concepts of Environmental Chemistry-G.S.Sodhi,Narosa Publishing House, New Delhi,2002
12. Environmental Education –V.K. Rao, R.S. Reddy, Commonwealth ublisher, New Delhi.
13. Textbook of Environmental Science-R.N. Trivedi, Amol Publications private limited,1997
14. Man and Environment-P.R. Trivedi, Gurdeep Raj, Akshadeep Publishing House, NewDelhi, 1997.
15. Environmental Studies-Kuashik and Kaushik, New Age International Publishers, 2004.
16. Environmental Geography-Savindra Singh. Prayag Pustak Bhawan, Allahabad (U.P.) 2001.
17. Fundamental Concepts in Environmental Studies – Dr. D.D. Mishra, S. Chand Publication, 2009.
18. Environmental Chemistry-A.K.DE, New Age International Publishers, 2001.

CORE GROUP

SUBJECT- I,

STUG01ENVS002

Introduction to Environmental science

Practical

1. Measurement of atmospheric pressure by barometer
2. Measurement of relative humidity by psychrometer
3. Measurement of wind velocity using anemometer
4. Analysis of web based real-time meteorological data
5. Measurement of rainfall by non-recording rain gauge
6. Determination of pH of the rainwater
7. Determination of electrical conductivity of the freshwater
8. Determination of temperature of the atmosphere
9. Megascopic identification of rocks
10. Determination of total acidity and total alkalinity of the rainwater
11. Determination of chloride of soil sample

References

1. Guidelines for Water Quality Monitoring,2007, CPCB, New Delhi,
2. Sharma B.K., (2001), Water Pollution, Goal publishing house, Meerut.
3. Pandey S.K. Tiwari S., (2009), Physico- chemical analysis of ground water of selected area of Ghazipur city-A case study, Nature and science. Vol. 7(1), pp 17-20.
4. ICMR (1975), Indian council of Medical Research Manual of standard of Quality of Drinking water supplies. 2nd Ed. Special Report series No. 44, New Delhi.
5. Reza. R. and Singh G., (2009), Physico- chemical Analysis of Ground water in Angul- Talcher region of Orissa , India, Journal of American Science, Vol.5(5), pp 53 – 58
6. ICMR (1975), Indian council of Medical Research Manual of standard of Quality of Drinking water supplies. 2nd Ed. Special Report series No. 44, New Delhi.
7. APHA (American Public Health Association, American water works Association and water pollution control federation). (1980), Standard methods for the examination of water and waste water, Publication Health Association, washington, DC, USA.

B.Sc. Part I SEM I

SKILL ENHANCEMENT COURSE

STUG01ENVS003

Environmental Monitoring and Analysis

Course Objectives:

1. The objective is to raise awareness of safety issues and support secure work procedures in laboratories.
2. To assist students, understand the principles and functions of different analytical instruments.
3. To provide students hands-on training and allow them to handle the analytical instruments.

Learning outcomes:

1. The students will have the ability to handle and operate scientific instruments.
2. Analytical instruments will be utilized by the students for practical applications.

A. Laboratory safety Rules and Regulations

1) Demonstrations and practical on laboratory safety rules and regulations, common rules for every laboratory, good laboratory practices, general safety guidelines, lab attire, and hygiene practices.

2) Demonstration and hands-on practicals on the standard operating procedures, meniscus reading techniques, and calibration of burettes, pipettes, micropipettes, volumetric flasks, and measuring cylinders.

3) Demonstration and hands-on practical on calibration of analytical balances.

4) Demonstration and hands-on practical on the setup, Köhler illumination alignment, safe focus protocols, and proper care of microscopes.

B. Sampling of environmental components

1) Practical on the preparation of standard solutions: Direct preparation of primary standards and standardization of secondary standards.

2) Practical on water-quality sampling methods and the operation of field sampling devices.

3) Practical on environmental sample preservation techniques.

4) Demonstration and hands-on practical on soil sampling methods, the operation of tools, and post-collection processing and storage protocols.

C. Ecology of freshwater ecosystem

1) Practical on the sampling, preservation, and analysis of phytoplankton and zooplankton in water bodies.
2) Practical on the sampling and study of macrophytes in water bodies.

D. Instrumentation for environmental analysis

1) Practical on the standard operating procedures and analysis of water samples using pH meter.
2) Practical on the operational methods and analysis of water samples using turbidity meter.

3) Practical on the operating methods of conductivity meter and the analysis of water samples.
4) Practical on determination of total hardness of the water samples.
5) Practical on determination of moisture content of soil.
6) Practical on determination of bulk density of soil.
7) Practical on determination of water holding capacity of soil.
8) Practical on measurement of rainfall by Rain gauge

Field Visit:

1) Visit to Botanical Garden/Biodiversity Park.
2) Visit to National Park/ Wildlife Sanctuary.
3) Visit to Lakes for sampling of water.
4) Visit to solid waste management sites of municipal corporation+n
5) Visit to water /sewage/wastewater/ treatment plant.
6) Visit to M.I.D.C. zones of city

References:

1. Laboratory Manual on Water Analysis, National Environmental Engineering Research Institute Nehru Marg, Nagpur-440 020 June.5th 1987
2. Water Quality Analysis Laboratory Methods, Dr. (Mrs.) Leena Deshpande, National Environmental Engineering Research Institute (NEERI), Nagpur Council of Scientific & Industrial Research, New Delhi, Govt. of India
3. Guide Manual, Water and Wastewater Analysis, CPCB
4. Baird, R., & Bridgewater, L. (2017). Standard methods for the examination of water and wastewater. 23rd edition. Washington, D.C.: American Public Health Association.
5. Chemistry for Environmental Engineering and Science, Sawyer, Mc Carty and Parkin 5 th Edn.
6. Pandey S.K. Tiwari S., (2009), Physico- chemical analysis of ground water of selected area of Ghazipur city-A case study, Nature and science. Vol. 7(1), pp 17-20.
7. ICMR (1975), Indian council of Medical Research Manual of standard of Quality of Drinking water supplies. 2nd Ed. Special Report series No. 44, New Delhi.
8. Reza. R. and Singh G., (2009), Physico- chemical Analysis of Ground water in Angul-Talcher region of Orissa , India, Journal of American Science, Vol.5(5), pp 53 – 58
9. ICMR (1975), Indian council of Medical Research Manual of standard of Quality of Drinking water supplies. 2nd Ed. Special Report series No. 44, New Delhi.
10. APHA (American Public Health Association, American water works Association and water pollution control federation). (1980), Standard methods for the examination of water and waste water, Publication Health Association, washington, DC, USA.
11. Laboratory Safety Manual (2020), Institute of Advanced Study in Science and Technology (IASST), Garchuk, Guwahati- 781035

GONDWANA UNIVERSITY

GADCHIROLI



National Education Policy 2020

FACULTY OF SCIENCE AND TECHNOLOGY

Syllabus B.Sc. Semester II

Program: FYUGP

Major Course: Environmental Science

With effect from 2026-2027

B.Sc. Semester II

TEACHING AND EXAMINATION SCHEME

Gondwana University, Gadchiroli

NEP 2020 U.G.

PROGRAMME: SESSION 2026-2027

GUGSTUGENVS

Faculty of Science and Technology

Programme Name - B.Sc. Sem. II (Environmental Science)



Gondwana University, Gadchiroli
NEP 2020 U.G. PROGRAMME SESSION 2026-27
Faculty of Science and Technology
Programme Name- B.Sc. Sem. II (Environmental Science) (Level 4.5) Examination Scheme & Basket

Sr. No.	Course Category	Subject Name		Subject code	Total Credit	Teaching Scheme (Hrs)			Examination Scheme									Total Marks
									Theory					Practical				
						Theory	Practical	Total Hrs.	UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark	Min. Passing	
1	Core Subjects	Select any Three core group subject from Annexure-V	i) Subject I – Ecology	STUG02 ENVS001	02	02	-	02	40	10	50	20	03	-	-	-	-	50
			ii) Subject II		02	02	-	02	40	10	50	20	03	-	-	-	-	50
			iii) Subject- III		02	02	-	02	40	10	50	20	03	-	-	-	-	50
			i) Practical Based on Subject –I Practical in Ecology	STUG02 ENVS002	02	-	04	04	-	-	-	-	-	30	20	50	25	50
			ii) Practical Based on Subject –II		02	-	04	04	-	-	-	-	-	30	20	50	25	50
			iii) Practical Based on Subject –III		02	-	04	04	-	-	-	-	-	30	20	50	25	50
2	VSC	Ecological Field and Applied Experiments (Annexure VI)		STUG02 ENVS003	02	-	-	04	-	-	-	-	-	-	20	50	25	50
3	SEC	Basic Experimental Skills in Environmental Science (Annexure VII)		STUG02 ENVS004	02	-	-	04	-	-	-	-	-	-	20	50	25	50
4	VEC	Audit Course (College level exam) (Annexure –VIII)			02	02	-	02	-	50	50	20	-	-	-	-	-	50
5	AEC	English/Marathi/Hindi/Bengali/Pali/ Supplementary English (Annexure-IX)			02	02	-	02	40	10	50	20	-	-	-	-	-	50
6	CC	NCC/NSS/Yoga/Sports (Any One) (College level exam)			02	-	04	04	-	-	-	-	-	-	50	50	25	50
Total					22	10	24	34	160	90	250	100	11	150	150	300	150	550

B.Sc. I SEM II
CORE GROUP SUBJECT-I
STUG02ENVS001
Ecology

Course objectives

The objective of this course is to:

Define ecology, define the subdisciplines of ecology, become familiar with the variety of ways that organisms interact with both the physical and the biological environment, Develop an understanding of the differences in the structure and function of different types of ecosystems.

Unit I: Basics of Ecology

1. **Fundamentals of Ecology**: Definition of ecology. Concepts of ecology. Objectives of the study. Levels of ecology. Modern branches of ecology. Scope of ecology.
2. **Environment in Action**: Definition of environmental factors. Types of environmental factors. Abiotic factors: Temperature, light, water, humidity, precipitation, fire, wind and microclimate.
3. **Interactions among Organisms**: Biotic interactions. Positive interactions: Mutualism, commensalisms, protocooperation. Negative interactions: Exploitation, antibiosis, competition.

Unit II: Organisms Ecology

1. **Population Ecology**: Definition. Characteristics of population: natality, mortality, age distribution, growth (S and J shaped curve), dispersion, migration. Biotic potential andConcept of carrying capacity. Estimation of population density.Age structure of population.
2. **Community Ecology**: Definition. Characteristic of community: species diversity, growth form and structure, succession and trophic structure. Ecotone and edge effect. Ecological niche. Key stone species. Ecotypes and its significance.
3. **Community Dynamics**: Definition of ecological succession. General process. Types. Other types of succession: xerosere, hydrosere and mesarch.

Unit III: Ecosystem Ecology

1. **Ecosystem**: Definition. Types of ecosystems. Terrestrial: forest and grassland. Aquatic: lotic and lentic. Structure and function of an ecosystem. Food chain: grazing and detritus. Ecological pyramids: number.
2. **Ecosystem Processes**: Definition of productivity. Fundamental aspects of productivity: Primary productivity: GPP, NPP. Net Community Productivity (NCP) and Secondary Productivity (SP). Measurements of productivity: oxygen method and carbon dioxide method.
3. **Biogeochemical Cycles**: Definition. Classification. Gaseous cycle: Oxygen, Carbon and Nitrogen cycle. Sedimentary cycle: Sulphur and Phosphorous cycle.

Unit IV: Ecology and Eco-Stability

1. **Habitat ecology**- Characteristic features: Aquatic-Fresh water ecology, Marine Ecology, Estuarine ecology. Terrestrial ecology- desert ecology.
2. **Adaptation:** Types of adaptations. Adaptation in plants: hydrophytes, mesophytes and xerophytes. Adaptation in animals: aquatic and desert.
3. **Concept of Eco-stability:** Ecological perturbation (natural and anthropogenic, impact on ecosystem and organism). Plant invasion, Ecological resistance, ecological resilience, climax communities, ecosystem restoration. Ecological indicators.

References:

1. Ecology and Environment-P.D. Sharma, Rastogi Publication, 2001.
2. Environmental Biology and Toxicology-P.D. Sharma, Rastogi Publication ,2004.
3. Animal Ecology and Environmental Biology-H.R. Singh, Vishal Publication.
4. Animal Physiology and Ecology-P.S. Varma, V.K. Agrawal, B.S. Tyagi ,S.Chand,2002.
5. Environmental Biology-P.S. Varma and V.K.Agrawal, S. Chand, 2001.
6. Ecology-E.P. Odum, Oxford and IBH Publishing.
7. Environmental Ecology-P.R. Yadav, Shubhrata. R. Mishra, Discovery Publishing House,2004.
8. Fundamentals of Environmental Biology-S. Arora, Kalyani Publishers, 1985.
9. Plant Ecology and Soil Science-R.S. Shukla and P.S. Chandel, S. Chand Publication, 2001.
10. Environmental Management-Dr. Anand S. Bal, Himalaya Publication, 2009.
11. Maintaining Biodiversity in Forest Ecosystem-Malcolm L. Hunter Jr., Cambridge University Press, 1999.
12. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology-P.S. Verma, V.K.Agarwal. S. Chand Publication, 2005.

B.Sc. I SEM II
CORE GROUP SUBJECT-I
STUG02ENVS002
Practical in Ecology

1) Water sampling for Ground and Surface Water and its Storage Techniques.
2) Estimation of Chloride of Water and Wastewater sample by Argentometric method.
3) Estimation of Alkalinity of Water and Wastewater sample.
4) Estimation of Acidity of Water and Wastewater.
5) Estimation of free CO2 of Water and Wastewater sample.
6) Estimation of Total solids, Dissolved Solids, Suspended Solids of Water and Wastewater Sample.
7) Determination of Moisture Content of Soil
8) Determination of Bulk Density of Soil
9) Determination of Water Holding Capacity of Soil
10) Measurement of Rainfall by Rain gauge.
11) Measurement of Primary Productivity in a water body by Light and Dark bottle method.
12) Study of plant communities by Quadrate method and study its characteristics i.e. Density, Frequency, and Abundance.
13) Qualitative and quantitative analysis of plankton by S-R cell

B.Sc. I Semester II
VOCATIONAL SKILL COURSE (VSC)

STUG02ENVS003
Ecological Field and Applied Experiments

Practical

1. Estimation of density and relative abundance of species using quadrats and plotless methods.
2. Estimation of species diversity.
3. Studies on ecological adaptations of the Plant and animal species in the hydrosere and xerosere.
4. Nutrients cycling in forest: Soil sampling & Organic carbon analysis
5. Methods of estimating forest /tree biomass
6. Measurement of the Primary productivity ofthe lakes by Light and Dark bottle method.
7. Determination of Alkalinity of the lake/pond water sample by titration method.
8. Determination of Acidity of the lake/pond water sample by titration method.
9. Determination of Hardness of the lake/pond water sample by EDTA titration method.
10. Determination of Dissolved Oxygen in the lake/pond water sample by Winkler's method with Azide modification.
11. Determination of moisture content of the given soil sample.
12. Determination of total organic carbon and percent organic matter of the given soil sample
13. Measurement of the rainfall by Rain gauze.
14. Observation and study of the following relationship:

I. Predator: Duck, Fish

II. Parasites: Cuscuta

III. Symbiosis: Lichens, Admesia (Sea anemone)

IV. Mutualism: Rhizobium, Termite, Honeybee

B.Sc. I Semester II
SKILL ENHANCEMENT COURSE(SEC)
STUG02ENVS004
Basic Experimental Skills in Environmental Science

1. The determination of pH in water samples, including sample handling, temperature compensation, cleaning procedures, preparation of standard buffer solutions, calibration of instruments, and precise measurement techniques.

2. The estimation of total solids, total dissolved solids, and total suspended solids by following systematic steps: cleaning, desiccation, analytical procedures, constant weight, representative sampling, and proper handling.

3. The determination of conductivity of water samples by using a calibration standard and a rinsing agent, followed by the measurement of the samples.

4.The estimation of turbidity of the water samples by preparation of the sample, calibration of the turbidimeter, recording and interpreting the results.

5. The determination of chloride in water samples by burette preparation, accurate meniscus reading, titration with silver nitrate, detection of the end point, and calculation of chloride concentration.

6. Determination of hardness of water samples by collecting the sample, preparing the burette, accurately reading the meniscus, adding a buffer, using an indicator, titrating with EDTA, identifying the endpoint, and calculating the hardness.

7. The determination of dissolved oxygen in water samples by collecting the samples without trapping air bubbles, fixing oxygen, acidifying, titrating, adding an indicator, and calculating the dissolved oxygen concentration.

8. Determining transparency of the water sample by collecting a sample, setting up a transparency tube or a Secchi disk, observing visual clarity, documenting, and analyzing the observations.

9. The determination of water sample temperature by collecting the sample, preparing the thermometer, immersing the thermometer, reading the meniscus or digital display, and recording and interpreting the results.

10.The determination of water sample by collecting the sample, preparing colour standards, performing visual comparison, conducting instrumental measurement, and recording and interpreting the results.

References

1. Standard methods for Examination of Water and Wastewater,18th edition 1992, American Public Health Association (APHA), American Water Works Association (AWWA), New York.

2. Water and wastewater analysis. National Environmental Engineering Research Institute (NEERI), Nagpur.

3. A Textbook of Experiments and Calculations in Engineering Chemistry- S.S. Dara, S.

Chand and Company Ltd. New Delhi 2003.

4. Handbook of Methods in Environmental Studies, Vol-I Water and Waste Water AnalysisS.K. Maity, ABD Publishers, Jaipur India.

5. Handbook of Methods in Environmental Studies, Vol-II Air, Noise, Soil Over Burden

Solid Waste And Ecology- S.K. Maity, ABD Publishers, Jaipur India.

6. A Manual of Water and Wastewater Analysis: Dr D.S. Ramteke and Dr C.A. Moghe,

Published by NEERI, Nagpur, 1996.

7. Laboratory Manual of Environmental Chemistry: Dr Snita Hooda and Dr Sumanjeet Kaur, S.

Chand and Co. Ltd. New Delhi.1997.

8. Physico-chemical Examination of Water Industrial Effluents: N. Manivaskaram, Pragti

Prakashan, Meerut (U.P) 1996.

9. Chemical and Biological Methods of Water Pollution Studies: R.K. Trevedi and P.K. Goel,

Enviro Media Publication.

10. Hand book of methods in environmental studies by S. K. MAITI, ABD Publishers, Jaipur, India.

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Question paper pattern

Time: 3 Hours **Max. Marks: 40**

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1. Long Question from unit I **8 marks**

OR

a. Short Question from unit I 4marks

b. Short Question from unit I 4 marks

2. Long Question from unit II **8 marks**

OR

a) Short Question from unit II 4 marks

b) Short Question from unit II 4 marks

3. Long Question from unit III **8 marks**

OR

a) Short Question from unit III 4 marks

b) Short Question from unit III 4 marks

4. Long Question from unit IV **8 marks**

OR

a) Short Question from unit IV 4 marks

b) Short Question from unit IV 4 marks

5. Answer in brief: 8 Marks

Solve any 8 out of 12 questions (3 questions from each unit) (1 mark each)