



***Swami Ramanand Teerth
Marathwada University, Nanded.***

***Revised Curriculum
B. Sc. Third year
(Semester V & VI)
Environmental Science***

W.e.f. : June, 2018.

Swami Ramanand Teerth Marathwada University, Nanded.
Syllabus Structure

B.Sc. Third year : **Environmental Science**

Sem.	Course No.	Name of the Course	Instruction Hrs / Week	Total Period	Internal Evaluation	Marks of semester	Total Marks	Credits
V SEM	DSEENVI (Section A)	Water Pollution and Waste Water Analysis (P-XII)	03	45	10	40	50	2
	DSEENV I [(Section B I) OR DSEENV I (Section B II)	Environmental Instrumentation- I (P-XIII) OR Environmental Education and Biodiversity	03	45	10	40	50	2
	SECENV III	SEC III Soil conservation Practices			50	-	50	(2)*
VI SEM	DSEENV II (Section A)	Waste water Engineering P – XIV	03	45	10	40	50	2
	DSEENV II [(Section B I) OR DSEENV II (Section B II)	Environmental Instrumentation-II (P - XV) OR Environmental Management	03	45	10	40	50	2
	SECENV IV	Sec IV Waste Water Analysis Techniques			50	-	50	(2)*
Annual Pract	DSEENV I [DECMB I & II Section A]	Practical's based on P-XII, & PXIV (P-XVI)	04	20 Practical	10	40	50	2
	DSEENV I DECENV I & II Section B)	Practical's based on P-XIII & P-XV (P - XVII)	04	20 Practical	10	40	50	2
Total Credits Semester V & VI								12 (4)*

DSEENV – Discipline Specific Elective Environmental Science
DCEENV – Discipline Specific Elective Environmental Science Practical
SECENV - Skill Enhancement Course Environmental Science

DECENV I (Section A) :
Water pollution and Waste water Analysis
P - XII

Salient Features :

01. To study various sources of water and waste water.
02. To understand it's quality through physico – chemical and biological characters

Objectives: To understand scientific reasons of point and non point source of water pollutants which enable to give correct suggestions for it's proper treatment.

Unit I : Introduction

Definition of water pollution, sources of water pollutants, point and non point source pollution, types of water pollution: domestic and industrial; Surface water pollution and ground water pollution (07)

Unit II : Quality of sewage :

Purpose of sanitation; Principles of sanitation; Sanitary projects; Site for sewage treatment works; Sewerage systems : separate system, combined system, partially separate system (06)

Quality of sewage : Physical properties: Colour, Odour, Turbidity, Temperature, Solids; **Chemical properties:** Hydrogen ion concentration, Dissolved oxygen, Dissolved carbon di oxide, Chlorides, Hardness, Nitrogenous wastes, metals, Bio chemical oxygen demand, Chemical oxygen demand; **Biological characteristics:** Bacteria, Fungi, Rotifers, Protozoa, Crustaceans, Viruses, Population equivalent (12)

Unit III : Analysis of sewage & Natural Methods of sewage disposal:

Physical tests : Color, Odor, Temperature, Turbidity; Chemical tests : Chlorine, Oil & Grease, Nitrogen, Oxygen, Hydrogen ion concentration (pH), Total Solids; Bacteriological tests : MPN, IMVIC, Population equivalent. (10)

Disposal by dilution, Self purification of natural waters, Disposal by land treatment, Sewage as fertilizer; Methods of applying sewage: Basin method, Flooding method, furrow method, managed turf method, Zig Zag method. (10)

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References

1. **Waste water treatment for pollution control :** *Soli J. Arceivala (Tata Mc-Grew Hill Publishing Company, New Delhi)*
2. **Water supply and sanitary engineering :** *R. C. rangwala and S. C. rangwala (Charotal publishing house, Anand)*
3. **Waste water treatment :** *M. N. Rao, A. K. Datta (Oxford and IBH publishing company, New Delhi)*
4. **A Text book of Sanitary Engineering :** *Vinayak Gharpure (Engineering Book Publishing Company, Pune)*
5. **Water Pollution :** *V. P. Kudesia (Pragati Prakashan, Meerut)*
6. **Environmental Chemistry :** *B. K. Sharma (Goel Publishing House, Meerut)*
7. **Waste water Engineering :** *Metcalf and Eddy (Tata Mc-Grew Hill Publishing Company, New Delhi)*
8. **Environmental Chemistry :** *A. K. De (Wiley eastern limited, New Delhi)*
9. **Environmental Pollution :** *H. M. Dix (New York)*
10. **Aquatic Plants for the Waste Water Treatment :** *Alkarani Upadhaya (Daya Publishing House, New Delhi)*
11. **Environmental Chemistry :** *B. K. sharma and H. Kour (Villa Publication, Meerut)*
12. **Introduction to Environmental Engineering :** *Mackenzie L. Davis & David A. Cornwell (Mc-Grew Hill Publishing Company, New Delhi)*
12. **Basic Water Treatment :** *George Smethurst (Scientific Publishers, Jodhpur)*
13. **Water Pollution and disposal of Waste water on Land :** *U. N. Mahida (Tata Mc-Grew Hill Publishing Company, New Delhi)*
14. **A Manual on Water and Waste Water Analysis :** *National Environmental Engineering Research Institute, Nagpur*

DECENV –I [(Section – B) Elective – I]
Environmental Instrumentation – I
P - XIII

Salient Features :

01. To study Instrumental methods used in Environmental Science studies.
02. To study applications of these instruments in environmental science studies.

Objectives: To understand principle, working and use of various scientific Instruments which are used in Environmental analysis.

Unit I : Introduction :

Classification of Instrumental methods, Types of errors : Determinate errors, Indeterminate errors, Precision and accuracy, Methods of expressing accuracy : Absolute errors, Relative errors. (05)

Unit II : Nephelometry, Turbidometry Measurement of pH, Redox potential and conductivity : Nephelometry & Turbidometry : Introduction, Theory, Factors affecting measurement, Turbidometers,

Nephelometers, Applications of Turbidometry and Nephelometry in Environmental studies (10)

PH and Redox potential measurement : Introduction, pH indicator method, potentiometry method, Types of electrodes, advantages and disadvantages, applications of pH meter. (08)

Conductivity measurement : Introduction, Definitions of various terms, Conductance measurement, Methods of conductance measurement, applications of conductivity measurement. (07)

Unit III : Chromatography :

Principles, Methods and applications of Thin Layer Chromatography (TLC): working and applications; Column chromatography: working and applications; Gas chromatography (GC): working and applications; High performance liquid chromatography (HPLC) : working and applications; Gas-liquid chromatography (GLC): working and applications; Ion exchange chromatography: working and applications. (15)

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References

1. **Instrumental Methods of Chemical Analysis :** Gurdeep Chatwal (Himalaya Publishing House, New Delhi), 2000
2. **Instrumental Methods of Analysis :** Willered Merit and Dean (CBS Publication, New Delhi)
3. **Instrumental Methods of Environmental Analysis :** Karan Sareen, (Sarup ans Sons Publishers, New Delhi), 2001
4. **Instrumental Methods of Chemical Analysis :** B. K. Sharma, Goel Publishing House, Meerut (1996).
5. **Standard Methods for the Examination of Water and Waste Water :** (APHA, AWWA & WPCF), 1985
6. **Instrumental Methods and chemical Analysis :** H. Kaur, Pragati Prakashan, Merrut (2009).
7. **Instrumental Analysis :** Shoog Holler (Harcourt Asia Publishers Ltd., New Delhi), 1952
8. **Instrumental Methods of chemical Analysis :** Chatwal and Anand (Himalaya Publishing House, New Delhi), 1994
9. **Instrumental Methods :** V. B. Borade (Nirali Prakashan, Mumbai)
10. **Instrumental Analysis for science and technology :** W. Ferren (Agrobios India, Jodhpur)

**DECENV [(Section – B) Elective – II]:
ENVIRONMENTAL EDUCATION AND BIODIVERSITY
P - XIV**

Salient Features :

01. To understand the goals and objectives of Environmental Education.
02. To understand the importance of Biodiversity and natural resources.

Objectives: Environmental education for better understanding and upliftment of biodiversity and natural resources..

Unit I : Environmental education

Environment, Ecology, Environmental Science, Environmental education, Goals and objectives of Environmental education, Principles of Environmental education, Role of green teacher in Environmental education. Environmental education in India : Formal Environmental education, Environmental education at higher secondary stage, Environmental education at college, Non formal Environmental education. (20)

Unit II: Biodiversity

Introduction, Definition, Genetic, species and Ecosystem diversity, Biogeographical classification of India, India as Mega diversity Nation, Value of biodiversity, Consumptive and Productive use, Social Ethical and Optional values. Biodiversity of Global, National and Local levels, Hotspots of biodiversity, Threats of biodiversity, Habitat loss. (10)

Unit III : Natural Resources :

Conventional Energy resources : Coal, Petroleum and natural gas, Nuclear energy, Geothermal energy, Management of Conventional Energy resources.

Non Conventional Energy resources : Solar energy, Hydro energy, Tidal energy, Biomass energy, Wind energy, management of non Conventional Energy resources.

Forest resources : Uses of forest resources, wood products, wood consumption, wood demand, Non wood products, trade of forest products, deforestation, A forestation, Social forestry, Forest management, National forest policy.

Wild life resources : Wild life and Environment, endangered species, causes of depletion of wild life, wild life trade, wild life management (15)

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References

1. **Environmental Education :** *Bombay Natural History Society*
2. **Principles of Ecology :** *P. S. Verma, V. K. Agarwal (S. Chand and Co. New Delhi)*
3. **Environmental Management :** *Sandeep Joshi (shrishti Eco – Research Institute, Pune)*
4. **Environmental Biology :** *P. D. sharma (Rastogi Publications, Meerut)*
5. **Ecology and Environment :** *P. D. sharma (Rastogi Publications, Meerut)*
6. **Principles of Environmental Biology :** *P. K. G. Nair (Himalaya Publishing House, New Delhi)*
7. **Environmental Biology :** *M. P. Arora (Himalaya Publishing House, New Delhi)*
8. **Environmental Science :** *Enger Smith, Smith, W. M. C. Brown (Company Publishing)*
9. **Pollution and Environmental laws :** *Satish Shastri*
10. **Introduction to Environmental Studies :** *Turk & Turk*
11. **Law Science and Environment :** *R. P. Anand*
12. **Conservation of Natural resources :** *David A. Castillan*
13. **Fundamentals of Environmental Science :** *G. S. Dahliwal, G. S. Sangha, P. K. ralthan, Kalyani Publishers, New Delhi*
Earth resources, Energy and the Environment : *Brookins*

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course

B. Sc. (Third Year) Semester- V

Effective From- June -2018

1. Skill Enhancement Course DECENV III

Soil conservation Practices

2 Credits

Paper - XV

Theory

(Lectures: 30)

Objective:

The main objective of the course is to imbibe the importance of soil and its conservation in students. Student will acquire the soil management skill. Student will know how to check the nutrient contents, deficiencies and its impact on food grain production. Conservation makes important contribution to social and economic development.

Syllabus to be covered:

Definition and introduction of soil. Origin and development of soil. Factors affecting soil formation. Soil erosion and its types. Principles and methods of soil conservation. Field visits to understand the mechanism of soil conservation practices.

For conservation of soil several methods have developed. These methods of soil conservation can be achieved by employing following methods.

Biological methods:

a) **Agronomic practices:** i) Contour farming ii) Mulching iii) Crop rotation iv) Strip cropping

b) **Agrostological methods:** i) Lay farming ii) grass farming.

Mechanical method: i) Contour terracing ii) Basin listing.

Other methods: a) Gully control b) Stream bank protection c) Afforestation.

References:

- 1. Fundamentals of Ecology:** Eugene P. Odum, (Natraj Publishers, Dehradun.)
- 2. Principles of Ecology:** P. S. Verma, V. K. Agarwal (S. Chand and Co. New Delhi)
- 3. Environmental Biology:** P. D. sharma (Rastogi Publications, Meerut)
- 4. Ecology and Environment:** P. D. sharma (Rastogi Publications, Meerut)
- 5. Principles of Environmental Biology:** P K G Nair (Himalaya Publishing House, New Delhi)
- 6. Environmental Biology:** M. P. Arora (Himalaya Publishing House, New Delhi)
- 7. Principles of Soil Science:** Watt K. E. F. (1973), (McGraw Hill Book Company, New Delhi)
- 8. Introduction to Environmental Studies:** Turk & Turk
- 9. Ecology and Field Biology:** Robert Leo Smith (Harper Collins college publication)
- 10. General Ecology:** H. D. Kumar (Vikas Publishing house, New Delhi)
- 11. Elements of Ecology:** Brijgopal, N. Bharadwaj (Vikas Publishing house, New Delhi)

DECENV II (Section A) :
Waste Water Engineering
P - XVI

Salient Features :

01. To understand the scientific process of treatment of waste water.
02. To know the load of waste water for appropriate primary / secondary / tertiary treatment.

Objectives: To give the proper treatment on the basis of load of waste water.

Unit I : Primary treatment of sewage :

Screens; Grit chambers; Detritus tank, Skimming tank; Sedimentation: Plain sedimentation tank, Primary

clarifiers, Secondary clarifiers, Coagulation of sewage. (12)

Unit II : Aerobic and Anaerobic treatment of sewage :

Aerobic Treatment : Activated sludge process: Action of activated sludge, aeration tank, Step aeration, Tapered aeration, extended aeration, Advantages of activated sludge process, Disadvantages of activated sludge process; Trickling filters: Standard rate trickling filters, High capacity trickling filters.; Oxidation ponds. (12)

Anaerobic treatment : Septic tank; Imhoff tank; Sludge digestion tank; Bio gas. (08)

Unit III : Tertiary treatment and Solid waste disposal :

Chlorination; Garbage collection and removal; Garbage disposal : Controlled tipping, disposal in to sea, filling of low lying areas, incineration, mechanical compost plant, pulverization, trenching; Night soil collection and disposal (13)

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References

1. **Waste water treatment for pollution control :** *Soli J. Arceivala (Tata Mc-Grew Hill Publishing Company, New Delhi)*
2. **Water supply and sanitary engineering :** *R. C. rangwala and S. C. rangwala (Charotal publishing house, Anand)*
3. **Waste water treatment :** *M. N. Rao, A. K. Datta (Oxford and IBH publishing company, New Delhi)*
4. **A Text book of Sanitary Engineering :** *Vinayak Gharpure (Engineering Book Publishing Company, Pune)*
5. **Water Pollution :** *V. P. Kudesia (Pragati Prakashan, Meerut)*
6. **Environmental Chemistry :** *B. K. Sharma (Goel Publishing House, Meerut)*
7. **Waste water Engineering :** *Metcalf and Eddy (Tata Mc-Grew Hill Publishing Company, New Delhi)*
8. **Environmental Chemistry :** *A. K. De (Wiley eastern limited, New Delhi)*
9. **Environmental Pollution :** *H. M. Dix (New York)*
10. **Aquatic Plants for the Waste Water Treatment :** *Alkarani Upadhaya (Daya Publishing House, New Delhi)*
11. **Environmental Chemistry :** *B. K. sharma and H. Kour (Villa Publication, Meerut)*
12. **Introduction to Environmental Engineering :** *Mackenzie L. Davis & David A. Cornwell (Mc-Grew Hill Publishing Company, New Delhi)*
13. **Basic Water Treatment :** *George Smethurst (Scientific Publishers, Jodhpur)*
14. **Water Pollution and disposal of Waste water on Land :** *U. N. Mahida (Tata Mc-Grew Hill Publishing Company, New Delhi)*
15. **A Manual on Water and Waste Water Analysis :** *National Environmental Engineering Research Institute, Nagpur*

DECENV II [(Section B) Elective I]:
Environmental Instrumentation – II
P - XVII

Salient Features :

01. To study Instrumental methods used in Environmental Science studies.
02. To study applications of these instruments in environmental science studies.

Objectives: To understand principle, working and use of various scientific Instruments which are used in Environmental analysis.

Unit I : Colorimetry and Fluoride meter :

Colorimetry : Theory, Lambert's law, Beer's Law, Working of Colorimetry, Applications.

Fluoride meter : Principle of operation, Salient features, Working Applications. (10)

Unit II : Spectrophotometry :

Principle and Operation of Spectrophotometer, Ultra Violet (UV) Spectrophotometer: working and applications;

Infra Red (IR) Spectrophotometer: working and applications, Nuclear Magnetic Resonance (NMR): working

and applications; Atomic Absorption Spectrophotometer (AAS): working, applications and its importance;

Flame Photometer: working and applications; Fluoride meter : utility and significance. (20)

Unit III : Flame Photometry :

Introduction, Principle, Instrumentation, Applications of flame photometry in environmental Analysis (15)

References

1. **Instrumental Methods of Chemical Analysis :** Gurdeep Chatwal (Himalaya Publishing House, New Delhi), 2000
2. **Instrumental Methods of Analysis :** Willered Merit and Dean (CBS Publication, New Delhi)
3. **Instrumental Methods of Environmental Analysis :** Karan Sareen, (Sarup ans Sons Publishers, New Delhi), 2001
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9. **Instrumental Methods :** V. B. Borade (Nirali Prakashan, Mumbai)
10. **Instrumental Analysis for science and technology :** W. Ferren (Agrobios India, Jodhpur)

DECENV II [(Section B) Elective II]:
Environmental Management
P – XVIII

Salient Features :

01. To study the principles of environmental management and various historical movements in environmental protection.
02. To study various laws and legislations of environmental protection.

Objectives: To understand various movements of environmental protection and the methods of environmental protection management through software tools and environmental laws.

Unit I : Environmental awareness & Management

Principles of Environmental Management : Introduction, Evolution of Environmental Management, Basic Principles of Environmental Management, Endangered and Endemic species: In India and in World countries, Conservation of biodiversity, In-situ and Ex-situ conservation. Major Environmental movements: Chipko movement, Silent Valley movement, Appiko movement, Narmada Bachao Andolan, Tehri Dam conflicts and ideological trends in Indian environmentalists. International Agreements and Environmental Awareness: Earth Summit, Convention of Biodiversity, United Nations Convention on Climate Change, Seminar, Conferences, Poster Exhibition, Public Participation, Training to the students (24)

Unit II : Environmental Impact Assessment and Remote sensing :

EIA : EIA process, preparation of EIA statement, Cost benefit analysis, current status of EIA, Projects covered by EIA, Environmental audit. EMS ISO 14000, Kyoto protocol.

Remote sensing : Maps, types of maps, satellite images, GPS, types of remote sensing, Remote sensing tools in environmental management, applications of remote sensing in oceanography, meteorology, wet land mapping, forest management, exploration of under ground water. (15)

Unit III : Environmental legislation : (Introduction, Rules & Regulations, Penalties)

Salient features of the Motor vehicle act 1988, Water prevention and control of pollution act 1974, Water prevention and control of pollution act 1977, Environmental protection act 1986, Wild life protection act 1972.

Biodiversity Act-2002

(06)

References

1. **Environmental Education :** *Bombay Natural History Society*
2. **Principles of Ecology :** *P. S. Verma, V. K. Agarwal (S. Chand and Co. New Delhi)*
3. **Environmental Management :** *Sandeep Joshi (shrishti Eco – Research Institute, Pune)*
4. **Environmental Biology :** *P. D. sharma (Rastogi Publications, Meerut)*
5. **Ecology and Environment :** *P. D. sharma (Rastogi Publications, Meerut)*
6. **Principles of Environmental Biology :** *P. K. G. Nair (Himalaya Publishing House, New Delhi)*
7. **Environmental Biology :** *M. P. Arora (Himalaya Publishing House, New Delhi)*
8. **Environmental Science :** *Enger Smith, Smith, W. M. C. Brown (Company Publishing)*
9. **Pollution and Environmental laws :** *Satish Shastri*
10. **Introduction to Environmental Studies :** *Turk & Turk*
11. **Law Science and Environment :** *R. P. Anand*
12. **Conservation of Natural resources :** *David A. Castilian*
13. **Fundamentals of Environmental Science :** *G. S. Dahliwal, G. S. Sangha, P. K. ralthan, Kalyani Publishers, New Delhi*
14. **Earth resources, Energy and the Environment :** *Brookins*

**DECENVP I : Laboratory Course
(Practical's based on P- XII & XIV)
P- XIX**

1. Study of sewage sampling Equipments.
2. Methods of sample collection.
3. Preservation of sewage samples.
4. Determination of Color of sewage sample.
5. Determination of pH of provided sewage sample.
6. Determination of Turbidity of provided sewage sample by turbidity meter method.
7. Determination of Total solids from the sewage sample.
8. Determination of Total dissolved solids from the sewage sample.
9. Determination of Volatile solids from sewage sample.
10. Determination of Conductivity of sewage sample.
11. Determination of Chlorides from provided sewage sample.
12. Determination of dissolved oxygen from sewage sample.
13. Determination of Carbon di oxide from sewage sample.
14. Determination of Oil & Grease from Sewage sample.
15. Determination of silica.
16. Determination of Ammonia from sewage sample.
17. Determination of Nitrates from sewage sample.
18. Estimation of hydrogen Sulphide from the wastewater.
19. Estimation of Biochemical oxygen demand of wastewater.
20. Estimation of Chemical oxygen demand waste water.

DECENVP- II (Elective I) : Laboratory Course
(Practical's based on P-XIII & XVII)
P-XX

Principle, Working, Standardization and applications of Instruments

1. pH meter
2. Turbidity meter
3. Conductivity meter
4. Thin layer chromatography
5. Column chromatography
6. BOD Incubator
7. Water testing Kit (Temperature measurement)
8. Water testing Kit (ORP measurement)
9. Water testing Kit (Salinity measurement)
10. Fluoride meter
11. Colorimeter (Estimation of Copper)
12. Colorimeter (Estimation of Zinc)
13. Colorimeter (Estimation of Manganese)
14. Colorimeter (Estimation of Ferrous)
15. Spectrophotometer (Estimation of Phosphate)
16. Spectrophotometer (Estimation of Sulphate)
17. Flame photometer (Estimation of Sodium)
18. Flame photometer (Estimation of Calcium)
19. Flame photometer (Estimation of Lithium)
20. Submission of Excursion Report

**DECENVP III (Elective II) : Laboratory Course
(Practical's based on P-XIV & XVIII)
P- XXI**

1. Determination of wind speed by anemometer.
2. Ecological adaptations (Xerophytes) (any two)
3. Ecological adaptations (Mesophytes) (any two)
4. Ecological adaptations (Hydrophytes) (any two)
5. Determination of Detergents.
6. Estimation of primary production by light and dark bottle Technique.
7. Study of Satellite image.
8. Study of GPS.
9. Estimation of chlorophyll content by Paper Chromatography.
10. Determination of organic matter from soil by Walkley's black method.
11. Estimation of Biomass.
12. Study of Ecological Maps
13. Estimation of hydrogen Sulphide from the wastewater.
14. Preparation of Air quality Impact Assessment Check list.
15. Preparation of Water quality Impact assessment Check list.
16. Preparation of Noise Impact assessment Check list.
17. Study of Grassland ecosystem in excursion tour.
18. Study of Forest ecosystem in Excursion tour.
19. Study of Aquatic ecosystem in excursion tour.
20. Study of Desert ecosystem in excursion tour.

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References

01. Practical Methods in Ecology and Environmental Science.

R. K. Trivedy, P. K. Goel, Trisal (Environmental Publication, Karad)

02. Manual of Environmental Pollution Analysis

N. N. Bandela, Masarat Sultana, Uday P. Patil (Prathivi Publication, Aurangabad)

03. A Manual of Fresh water ecology *R. Santhanam, P. Velayutham, G. Jegatheesan (Daya Publishing House, Delhi)*

04. Physico-Chemical Examination of Water, Sewage & Industrial effluents

N. Manivasakam (Pragati Prakashan, Meerut)

05. Manual on Water and Waste Water Analysis *National Environmental Engineering Research Institute, Nagpur*

06. Methodology for Water Analysis *Dr. Mohan S. Kodarkar, (Indian Association of aquatic Biologist's, Hyderabad)*

07. Chemical and Biological methods for Water Pollution Studies *R. K. Trivedy, P.*

K. Goel (Environmental Publication, Karad)

08. Methods in Environmental Analysis : Water, Soil, Air

P. K. gupta, (Agrobios India, Jodhpur)

09. Chemical methods for Environmental analysis: Water & Sediments

R. Ramesh & M. Anbu (Macmillan India Limited)

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course

B. Sc. (Third Year) Semester- VI

Effective From- June -2018

1. Skill Enhancement Course DECENVP- IV

Training course on waste water Analysis

2 Credits

Paper - XXII

Theory

(Lectures: 30)

Objective:

The main objective of the course is to make students aware and expert in handling waste water its analysis and use of various techniques and instruments. This course is designed to train students to safely and effectively operate advanced wastewater treatment plants in future.

Syllabus to be covered:

Definition and introduction of waste water or waste water pollution. Sources and types of water pollution. Physico-chemical characteristics of waste water. Collection and preservation of waste water sample for analysis. Tabulation and expression of results. Comparison with standard laid down by Indian standards Institutes.

Course content: Collection of sample and preservation with proper tools and techniques for its analysis. Analysis of waste water for its physical characteristic like colour, odour, turbidity, temperature. Analysis of chemical characteristics like pH, Acidity, Alkalinity, Chloride, Dissolved oxygen, Biological oxygen demand, chemical oxygen demand, Total solids, Total dissolved solids and Bacteriological examinations MPN, Faecal and non faecal coliforms etc.

References

- 01. Waste water treatment for pollution control:** *Soli J. Arceivala (Tata Mc-Grew Hill Publishing Company, New Delhi)*
- 02. Water supply and sanitary engineering:** *R. C. rangwala and S. C. rangwala (Charotal publishing house, Anand)*
- 03. Waste water treatment:** *M. N. Rao, A. K. Datta (Oxford and IBH publishing company, New Delhi)*
- 04. A Text book of Sanitary Engineering:** *Vinayak Gharpure (Engineering Book Publishing Company, Pune)*
- 05. Water Pollution:** *V. P. Kudesia (Pragati Prakashan, Meerut)*
- 06. Environmental Chemistry:** *B. K. Sharma (Goel Publishing House, Meerut)*
- 07. Waste water Engineering :** *Metcalf and Eddy (Tata Mc-Grew Hill Publishing Company, New Delhi)*
- 08. Environmental Pollution :** *H. M. Dix (New York)*
- 09. Aquatic Plants for the Waste Water Treatment :** *Alkarani Upadhaya (Daya Publishing House, New Delhi)*
- 10. A Manual on Water and Waste Water Analysis :** *National Environmental Engineering Research Institute, Nagpur.*
- 11. Hand Book of Methods in Env. Studies:** *S. K. MAITI, ABD Publishers, Jaipur, India.*
- 12. Instrumental Methods of Chemical Analysis:** *G. R. Chatwal and Anand Himalaya Publishing house, New Delhi*
- 13. Environmental Science Principle & Pract.:** *R. C. Das & Behera Prentice Hall of India Pvt. Ltd. New Delhi*