।। सा विद्या या विमुक्तये ।।

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील तृतीय वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, मा. विद्याशाखेने **दिनांक ३१ मे २०२१ रोजीच्या बैठकीतील केलेल्या शिफारशीप्रमाणे व दिनांक १२ जून २०२१ रोजी संपन्न झालेल्या ५१ व्या मा. विद्या परिषद बैठकीतील विषय क्र. २६/५१–२०२१**च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या **संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील तृतीय वर्षाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्यात येत आहेत.

1. B.Sc.-III Year-Biophysics
2. B.Sc.-III Year-Bioinformatics
3. B.Sc.-III Year-Biotechnology
4. B.Sc.-III Year-Biotechnology (Vocational)
5. B.Sc.-III Year-Botany
6. B.Sc.-III Year-Horticulture
7. B.Sc.-III Year-Agro Chemical Fertilizers
8. B.Sc.-III Year-Analytical Chemistry
9. B.Sc.-III Year-Biochemistry
10. B.Sc.-III Year-Chemistry
11. B.Sc.-III Year-Dyes & Drugs Chemistry
12. B.Sc.-III Year-Industrial Chemistry
13. B.C.A. (Bachelor of Computer Application)-III Year
14. B.I.T. (Bachelor of Information Technology)-III Year
15. B.Sc.-III Year-Computer Science
16. B.Sc.-III Year-Network Technology
17. B.Sc.-III Year-Computer Application (Optional)
18. B.Sc.-III Year-Computer Science (Optional)
19. B.Sc.-III Year-Information Technology (Optional)
20. B.Sc.-III Year-Software Engineering
21. B.Sc.-III Year-Dairy Science
22. B.Sc.-III Year-Electronics
23. B.Sc.-III Year-Environmental Science
24. B.Sc.-III Year-Fishery Science
25. B.Sc.-III Year-Geology
26. B. A./B.Sc.-III Year-Mathematics
27. B.Sc.-III Year-Microbiology
28. B.Sc.-III year Agricultural Microbiology
29. B.Sc.-III Year-Physics
30. B. A./B.Sc.-III Year Statistics
31. B.Sc.-III Year-Zoology

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.: शैक्षणिक–१/परिपत्रक/पदवी–सीबीसीएस अभ्यासक्रम/२०२१–२२/७५

दिनांक : १२.०७.२०२१.

स्वाक्षरित
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :
१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.
७) अधीक्षक, परिक्षा विभाग विज्ञान व तंत्रज्ञान विद्याशाखा प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTH
MARATHWADA UNIVERSITY, NANDED

Revised Curriculum

B. Sc. III year

Environmental Science

w.e.f. June 2021

Distribution of credits for B.Sc. Environmental Science (Optional)
Under Faculty of Science

B. Sc. III Year Syllabus Structure

Semester Pattern Effective From June, 2021

Subject: Environmental Science

B. Sc. III Year								
Sem	**Paper No.**	**Name of the Course**	**Instruction Hrs./Week**	**Total Period**	**Internal Evaluation**	**Marks of Semester Examination**	**Total Marks**	**Credits**
V	DECENV I (Section A)	Water Pollution and Waste Water Analysis P – XII	**03**	**45**	**10**	**40**	**50**	**02**
	DECENV I [(Section B) Elective-1] / DECENVI (Section B) Elective-II	Wild Life Management P – XIII (A) **OR** Environmental Legislation & Policy P – XIII (B)	**03**	**45**	**10**	**40**	**50**	**02**
	DECENVP II [DECMB I & IV	Practical's based on P-XII, XIII & PXIV P – XIV	**04**	**20** Practical's	**10**	**40**	**50**	**04**
	DECENV III	SEC III (1 Skill / optional)	**03**	**45**	**---**	**---**	**---**	**(02)***
VI	DECENV II (Section A)	Environmental Education and Biodiversity P – XV	**03**	**45**	**10**	**40**	**50**	**02**
	DECENV II [(Section B) Elective I] / DECENV II [(Section B) Elective II]	Environmental Instrumentation P – XVI (A) **OR** Environmental Impact & Risk Assessment P – XVI (B)	**03**	**45**	**10**	**40**	**50**	**02**
	DECENVP II) [DECENV I & II (Section B)]	Practical's based on P-XVI, P-XVII & P-XVIII P – XVII	**04**	**20** Practical's	**10**	**40**	**50**	**04**
	DECENVP II) [DECENV I & II (Section B)]	SEC IV	**03**	**45**	**---**	**---**	**---**	**(02)***

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. Third Year (Semester - V)

Semester Pattern Effective From -2021

ENVIRONMENTAL SCIENCE

DECENV I (Section A)

Core Course XII: WATER POLLUTION AND WASTE WATER ANALYSIS (P-XII)

Periods: 45 **Credits : 02** **Marks: 50**

Preamble: This paper is designed to impart the knowledge of water pollution and associated problems among the students. Students will be able to identify the proper source of pollution and learn different methods of waste water treatment. Proper knowledge and treatment methods make Students skilled in the area of waste water analysis. The knowledge of water pollution and their treatment method will definitely help serving the society.

Unit I: Introduction **(15)**

Definition of water pollution; **Sources of water pollution:** Domestic and Industrial; **Types of water pollutants:** organic pollutants, inorganic pollutants, pathogens, suspended solids, nutrients and agriculture pollutants, thermal, radioactive; Point and Non point source pollution; **Types of water pollution:** Physical, Chemical and Bacteriological pollution.

Unit II: Analysis of sewage **(15)**

Physical tests: Color, Odor, Temperature, Turbidity; **Chemical tests:** Chlorine, Oil & Grease, Nitrogen, Oxygen, Hydrogen ion concentration (pH),Total Solids; Total Dissolved Solids, BOD, COD. **Bacteriological tests:** MPN, IMVIC test.

Unit III: Treatment of sewage **(15)**

Primary treatment of sewage: Screen, Grit, Detritus tank, Skimming tank, plain sedimentation tank.

Secondary Treatment of Sewage: Contact beds, Intermittent sand filters, Trickling filters.

Disinfection: Chlorination of sewage.

Reference Books:

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 (Charcoal 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.

Learning Outcomes

1. Students will be able to understand the concept of water pollution.
2. Students will be able to identify the sources of water pollution.
3. They will be capable to analyze the waste water at any laboratory.
4. They can make people aware about their individual and social health.
5. They will be able to maintain the individual health and sanitation at public place.
6. Understand the importance of availability and use of water.

DECENV I (Section B) (Elective I)
Core Course XIII: WILD LIFE MANAGEMENT
(P-XIII – A)

Periods: 45 **Credits : 02** **Marks: 50**

Preamble:
1. The paper aims at introducing the students to the scientific and social perspective of conservation.
2. This paper deals with the conflicts that have arisen as a result of shrinkage of wildlife habitats and the same being shared by human communities.
3. It raises questions about the moral obligations of humans, need for conservation, and social impacts of conflicts.

Course Objectives:
1. To enable the student to better understand the need of environmental management and necessary to worry about human wildlife conflicts.
2. To create awareness about the Evolution of the concept of wildlife management.
3. It helps in attaining the knowledge on Human wildlife coexistence.

UNIT- I - Wildlife: An Introduction : **15**
1. Basic concept of wildlife; importance of wild life: Ecological value, Economic value, scientific value, aesthetic value, cultural and religious values, Ethical values.
2. Wildlife in India: Himalayan Mountain system; Peninsular-Indian sub-region; Tropical evergreen forests;
3. Endangered Flora and Fauna of India;
4. Threats to Indian wildlife: Habitat loss, grazing of livestock, mining activity, forest fire, construction of roads and railway tracts, pollution, global warming and climate change, population explosion
5. Threatened wildlife: Extinct (EX), Endangered (EN), Critical endangered (CE), Vulnerable (VU)

UNIT – II –Wildlife Conservation **15**
1. Aims and objectives of wildlife conservation; Wildlife conservation in India – through ages; Necessity for wildlife conservation
2. Modes of wild life conservation : *In-Situ* Conservation, *Ex-Situ* Conservation
3. Protected area network : Types of protected area: National Parks, Sanctuaries, Conservation Reserves, Community Reserves, Difference between National Parks, Wildlife Sanctuaries and Biosphere Reserves, **National parks** : Tadoba, Corbett, Borivali, Kanha, Ranthambore; **Sanctuaries:** koyna, Periyar, Chilka, Chinnar.
4. Wild life Management project in India : Project tiger, Project Elephant, Lion conservation project, Operation Rhino, Crocodile conservation Project.

UNIT – III- Wildlife Management **15**
1. Wild life management in India; 2. Indian board of wildlife;
2. Man, and wild life conflict : Human – Tiger conflict: Cause, Consequence and Mitigation; Human – Elephant
3. conflict: Cause, Consequence and Mitigation; Human – leopard conflict: Cause, Consequence and Mitigation
4. Application of remote sensing and GIS in wildlife studies.

Reference Books:

1. Ecology and Environment: P. D. sharma Rastogi Publications, Meerut.
2. Wild life Biology- An Indian perspective: Gautam Kumar Saha & Subhendu Mazumdar Published by Asoke K. Ghosh, PHI learning Private Limited-Rimjhim House, 111, Patarganj Industrial Estate, Delhi- 110092 and printed by raj press, New Delhi- 110012.
3. Conover, M. 2001. Resolving Human Wildlife Conflicts, CRC Press
4. Fundamentals of Ecology: Eugene P. Odum, Natraj Publishers, Dehradun.
5. Principles of Ecology: P. S. Verma, V. K. Agarwal S. Chand and Co. New Delhi.
6. Environmental Biology: P. D. sharma Rastogi Publications, Meerut.
7. Environmental Biology: M. P. Arora Himalaya Publishing House, New Delhi

Learning Outcomes :
1. The attention of the student increases on the need of environmental management and wildlife conservation.
2. The attention of the student increases on Human wildlife coexistence and Man and biosphere programs.
3. The student achieves basic knowledge on Wildlife conflicts with few case studies.

DECENV (Section B) (Elective II)
Core Course XIV : ENVIRONMENTAL LEGISLATION AND POLICY
(P-XIII - B)

Periods: 45 **Credits : 02** **Marks: 50**

Preamble: This paper introduces students the fundamentals of environmental legislation and policymaking. Each unit will help the students to develop basic concepts of environmental legislation and policy making in India and around the world.

Course Objectives:

Students will able to understand

1.Importance of Environmental Legislation & Policy
2.Prevention Strategies & pollution Control
3.International & National Policies for protection & Development of Environment

Unit - I: Introduction **(15)**

Need of laws, Importance of Environmental Legislation, National Environmental Policy Act (NEPA), History of Environmental laws in India: Laws about Environment in Historic Period, Environment related laws during British Rule, Constitutional Provision Related to Environment : Legal definitions (environmental pollution, natural resource, biodiversity, forest, sustainable development); Article 48A (The protection and improvement of environment and safeguarding of forests and wildlife); Article 51 A (g) (Fundamental duties),(Rules & Regulations).

Unit - II: Legislative Instruments in India **(15)**

The Indian Forest Act 1927; The Wildlife (Protection) Act 1972; The Water (Prevention and Control of Pollution) Act 1974; The Forests (Conservation) Act 1980; The Air (Prevention and Control of Pollution) Act 1981; The Environment (Protection) Act 1986; The Biological Diversity Act 2002; The Schedule Tribes and other Traditional Dwellers (Recognition of Forests Rights) Act 2006; The National Green Tribunal Act 2010.

Unit III: Environmental Policy : National & International: **(15)**

Government Policies in the protection and development of Environment, Role of Ministry of Environment, Forests & Climate Change in environmental law and policy making; role of central and state pollution control boards in environmental law and policy making. Stockholm Conference 1972; United Nations Conference on Environment and Development 1992; Riode Janeiro (Rio Declaration, Agenda 21); Montreal Protocol 1987; Kyoto Protocol 1997; Copenhagen and Paris summits; Ramsar convention.

Reference Books:

1. Abraham,C.M.1999.*Environmental Jur is prudence in India* .Kluwer Law International.
2. Agarwal, V.K. 2005. Environmental Laws in India: Challenges for Enforcement. *Bulletin of the National Institute of Ecology* **15**: 227-238.
3. Divan S.& Rosencranz,A.2001.*Environmental Law and Policy in India*. Oxford University Press.
4. Divan,S.& Rosencranz,A .2002.*Environmental Law and Policy in India: Cases, Materials and Statues* (2nd edition). Oxford University Press.
5. Gupta, K. R. 2006. *Environmental Legislation in India* .Atlantic Publishers and Distributors.
6. Leelakrishnan,P. 2008. *Environmental Law in India* (3rdedition). Lexis Nexis India.
7. Naseem, M. 2011. *Environmental Law in India Mohammad* .Kluwer Law International.
8. Venkat, A. 2011. *Environmental Law and Policy*. PHI Learning Private Ltd.
9. Trivedy R. K. 1996 Hand Book of Env. Laws, Acts, Rules, Guidelines, Compliance and Standard Vol. 1 & 2: Environmental Edition.
10. S. K. Mohanty 1998.Universal Environment and Pollution law manual.

Learning Outcomes :

1. Students will learn about Environmental rules and laws
2. Student will get the knowledge about Policy & Protection
3. Study the legal provisions made by various Environmental concern acts

DECENVP II
Laboratory Course
(Practical's based on P- XII, XIII & XIV)
(P- XIV)

01. Study of sewage sampling Equipments and Methods of sample collection.
02. Preservation of sewage samples.
03. Determination of pH of provided sewage sample.
04. Determination of Turbidity of provided sewage sample by turbidity meter method.
05. Determination of Total solids from the sewage sample.
06. Determination of Total dissolved solids from the sewage sample.
07. Determination of Conductivity of sewage sample.
08. Determination of Chlorides from provided sewage sample.
09. Determination of dissolved oxygen from sewage sample.
10. Determination of Carbon di oxide from sewage sample.
11. Determination of Oil & Grease from Sewage sample.
12. Determination of Ammonia and Nitrates from sewage sample.
13. Estimation of hydrogen Sulphide from the wastewater.
14. Estimation of Biochemical oxygen demand of wastewater.
15. Estimation of Chemical oxygen demand waste water.
16. Study of the: Endangered – "Great Indian Bustard" of Indian wildlife and state reasons for their decline
17. Study of the: Endangered – "Asiatic lion" of Indian wildlife and state reasons for their decline
18. Study of the: Endangered – "Olive Ridley sea turtle" of Indian wildlife and state reasons for their decline
19. Study of the: critically endangered species – "Gharial" of Indian wildlife and state reasons for their decline
20. Study of the: critically endangered species – "Malabar civet" of Indian wildlife and state reasons for their decline

Learning Outcomes :
01. Study the sewage sampling equipments and methods of sample collection..
02. Study the skill of handling various instruments used in Environmental analysis.
03. Acquire the Knowledge of treatment of sewage
04. Acquire the Knowledge of endangered and critically endangered species

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course

B. Sc. (Third Year) Semester- V

Effective From- June -2021

1. Skill Enhancement Course DECENV III

Soil conservation Practices

2 Credits **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. Fieldvisits 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) Stripcropping

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)

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Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. Third Year (Semester - VI)

Semester Pattern Effective From -2021

ENVIRONMENTAL SCIENCE

DECENV II (Section A)

Core Course XVI: ENVIRONMENTAL EDUCATION AND BIODIVERSITY (P-XV)

Credits: 02 **Marks: 50** **Periods: 45**

Preamble: This paper highlights the concept of Environmental Education and Biodiversity. It covers the Goals, objectives and principles of environmental education. The paper also consists the various aspects of biodiversity such as importance and conservation practices. It aims to aware the students regarding environmental education and biodiversity.

Unit I: Environmental education **15**

Introduction to Environmental education, Goals and objectives of Environmental education, Principles of Environmental education, Environmental education in India:Modes of Environmental Education: A) Formal Environmental education: Environmental education at higher secondary stage, Environmental education at college B) Non formal Environmental education.

Unit II: Biodiversity **15**

Introduction, Definition, Levels of Biodiversity : 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 to biodiversity, Habitat loss. Endangered and Endemic species: In India and in World countries.

Unit III: Biodiversity Conservation **15**

Conservation of biodiversity, Methods of Biodiversity conservation: a) In-situ conservation: National Parks, Wild life Sanctuaries, Biosphere reserve b) Ex-situ conservation: Gene bank; Seed bank; Cryopreservation; Tissue culture bank; Long term captive breeding. Major International Conventions: Convention on Biological Diversity, Convention on Migratory Species, Convention on International Trade in Endangered Species of WildFauna and Flora, Ramsar Convention, World Heritage Convention.

Reference Books:

1. **Environmental Education :***Bombay Natural History Society*
2. **Environmental Biology :***P. D. sharma (Rastogi Publications, Meerut)*
3. **Ecology and Environment :***P. D. sharma (Rastogi Publications, Meerut)*
4. **Principles of Environmental Biology :***P. K. G. Nair (Himalaya Publishing House, New Delhi* **Environmental Biology :** *M. P. Arora (Himalaya Publishing House, New Delhi)*
5. **Environmental Science :***Enger Smith, Smith, W. M. C. Brown (Company Publishing* **Introduction to Environmental Studies :** *Turk & Turk*
6. **Fundamentals of Environmental Science :***G. S. Dahliwal, G. S. Sangha, P. K. ralhan, Kalyani Publishers, New Delhi*
7. **Textbook of Environmental Studies for Undergraduate Courses:** ErachBharucha (Universities Press), 2013.
8. **Introduction to Environmental Science**. Anjaneyulu (B.S. Publication), 2008.
9. **Environmental Science:** UGC NET/SET (Danika Publishing Company), 2018.

Learning Outcomes:

01. Understand the concept and modes of environmental education.
02. Systematically understand biodiversity and its vital role in functioning of ecosystem
03. Study the importance of biodiversity in human welfare point of view.
04. Understand the methods of biodiversity conservation.

DECENV II (Section B) (Elective – I)
Core Course XVI: ENVIRONMENTAL INSTRUENTATION
(P-XVI - A)

Credits: 02 **Marks: 50** **Periods: 45**

Preamble: This paper highlights the study of the working of Instruments used in Environmental studies. In this paper the study of the applications of these instruments in environmental monitoring.
Objectives: To understand principle, working and application of various scientific Instruments used in Environmental Analysis.

Unit I : **15**
Introduction : Classification of Instrumental methods, Types of instruments
Fluoride Meter: Principle of operation, Salient features, Working, Applications.
Colorimeter: Theory, Lamberd's law, Beer's Law, Working of Colorimeter and its Applications.
Turbidity Measurement: Introduction, types of turbidity meter, factors affecting turbidity, Working and Applications of Turbidity meter.
pH Measurement : Introduction, pH indicator method, potentiometer method, Types of electrodes, advantages and disadvantages, applications of pH meter.
Conductivity Measurement: Introduction, Definitions of various terms, Conductance measurement, Methods of conductance measurement, applications of conductivity measurement.

Unit II : Chromatography : **15**
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.

Unit III : Spectrophotometry : **15**
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 andits importance.

Reference Books:

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)*

Learning Outcomes :
01. study the Types of Instruments
02. Study the Principles on which the instruments are working
03. Understand the Information of the working of the Instrument.
04. Study the applications of Instruments in Environmental analysis.

DECENV II (Section B) (Elective – II)

Core Course XVII: ENVIRONMENTAL IMPACT AND RISK ASSESSENT

(P-XVI - B)

Credits: 02 **Marks: 50** **Periods: 45**

Preamble: The Content of the paper will educate to the students about Environmental Impact Assessment as a planning tool in pollution control strategies for sustainable development. In risk assessment how to asses risk and identify hazard and what are the legal framework for this.

UNIT-I **12**

EIA ― Introduction ―Environmental impact assessment (EIA): definitions, introduction and concepts; rationale and historical development of EIA. Scope of EIA. Organization responsible for EIA . Site selection and area classification-Sitingand setting criteria for EIA projects.

UNIT-II **18**

Environmental Impact Statement (EIS), Environmental Management Plan (EMP): principles, problems and strategies, Various steps of EIA ,Content of EIA ,Assessment methodologies. Social Impact Assessment. Environmental Audit. Cost benefit analysis, EIA regulations in India; status of EIA in India; case study of hydropower projects/ thermal projects. Procedure for Environmental Clearance, List of the projects requiring Environmental Clearance.

UNIT-III **15**

Risk assessment: introduction and scope; project planning; exposure assessment; toxicity assessment; hazard identification and assessment; risk characterization; risk communication; environmental monitoring; community involvement; legal and regulatory framework; human and ecological risk assessment.

Reference Books:

01. Rau J.G. and Wooten D.C.(1980) Environmental Impact Assessment Handbook. Mc.Graw Hill, USA
02. Canter, L.W.(1977) Environmental Impact Assessment. Mc.Graw Hill, USA
03. Munn R.E.(1982) Environmental Impact Assessment. Mc.Graw Hill,New York
04. Barrow, C.J. 2000. Social Impact Assessment: An Introduction. Oxford University Press.
05. Glasson, J., Therivel, R., Chadwick, A. 1994. Introduction to Environmental Impact Assessment. London, Research Press, UK.
06. Judith, P. 1999. *Handbook of Environmental Impact Assessment*. Blackwell Science.
07. Marriott, B. 1997. *Environmental Impact Assessment: A Practical Guide*. McGraw-Hill, New York, USA.
08. Westman W.E. 1985, Ecology, ImpactAssessment and Environmental Planning, John Wiley, New York
09. Environmental Impact Assessment: Practical Solutions to Recurrent Problems, Wiley–Blackwell (14 October 2003)
10. Environmental Impact Assessment, S.R. Khandeshwar N.S. Raman, A.R. Gajbhiye, Dreamtech Press.New Delhi.

Learning Outcomes:

01. To have an understanding of the history of EA in fostering public engagement in environmental governance
02. To critically examine assumptions inherent in Environmental Impact Assessment.
03. To develop skills in identifying and solving problems
04. To consolidate the knowledge and skills essential to a career or further research in environmental impact assessment.
05. To understand the approach to risk Management through risk identification.

DECENVP II
Laboratory Course
(Practical's based on P- XVI, XVII & XVIII)
(P- XVII)

01. To study the environmental awareness in college students through questionnaire method
02. Preparation of charts / posters / model / slogan / video to create environmental awareness in public.
03. Collection and record keeping of news cutting regarding the environmental issues.
04. Estimation of primary production by light and dark bottle Technique.
05. Study of Plant Communities by Quadrate Method and to Study its Characteristic-Density, Frequency and Abundance.
06. To study the working of pH meter
07. To study the working of Turbidity meter
08. To study the working of Thin layer chromatography
09. To study the working of Column chromatography
10. To study the working of BOD Incubator
11. To study the working of Water testing Kit
12. To study the working of Fluoride meter
13. To study the working of Colorimeter
14. To study the working of Spectrophotometer
15. Flame photometer (Estimation of Sodium)
16. To Perform Green Audit of College campus / city
17. To Perform Energy Audit of College campus / city
18. To Perform water audit of College campus / city
19. To Perform Environmental Audit of College campus / city
20. To prepare a EIA Document of college campus / city

Learning Outcomes :
01. Understand the importance of environmental education forcreating environmental awareness.
02. Study the format and non-formal modes of environmental education.
03. Study the skill for preparation of posters, Models, Slogans, Vidios on environmental awareness.
04. Study the skill of handling various instruments used in Environmental analysis.
05. Acquire the Knowledge of performing the Environmental Audit
06. Acquire the Knowledge of performing EIA

Swami Ramanand Teerth Marathwada University Nanded
Choice Based Credit System (CBCS) Course
B. Sc. (Third Year) Semester- VI
Effective From- June -2018
Skill Enhancement Course DECENVP- IV
Training course on waste water Analysis

Credits : 02 **Theory (Lectures: 30)**

Objective:

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

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 NewDelhi)*
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, NewDelhi)*
08. Environmental Pollution :*H. M. Dix (New York)*
09. Aquatic Plants for the Waste Water Treatment :*AlkaraniUpadhaya (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.

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