॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड – ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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E-mail: bos@srtmun.ac.

विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० नुसार पदव्यूत्तर द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२४–२५ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, या विद्यापीठा अंतर्गत येणा–या सर्व संलग्नित महाविद्यालयामध्ये शैक्षणिक वर्ष २०२४–२५ पासून राष्ट्रीय शैक्षणिक धोरणानुसार पदव्यूत्तर द्वितीय वर्षाचे अभ्यासक्रम लागू करण्याच्या दृष्टीकोनातून विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत येणा–या अभ्यासमंडळांनी तयार केलेल्या पदव्यूत्तर द्वितीय वर्षाच्या अभ्यासक्रमांना मा. विद्यापरिषदेने दिनांक १५ मे २०२४ रोजी संपन्न झालेल्या बैठकीतील विषय क्रमांक १५/५९–२०२४ च्या ठरावाअन्वये मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील खालील एम. एस्सी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) लागू करण्यात येत आहेत.

1) M. Sc. II year Biotechnology (Affiliated College)
2) M. Sc. II year Biotechnology (Campus)
3) M. Sc. II year Bioinformatics (Sub Campus Latur)
4) M. Sc. II year Bioinformatics (Affiliated College)
5) M. Sc. II year Clinical Research (Affiliated College)
6) M. Sc. II year Botany (Campus)
7) M. Sc. II year Herbal Medicine
8) M. Sc. II year Boany (Affiliated College)
9) M. Sc. II year Geology (Campus)
10) M. Sc. II year Dairy Science
11) M. Sc. II year Electronics
12) M. Sc. II year Environmental Science
13) M. Sc. II year Environmental Science (Campus)
14) M. Sc. II year Geography (Campus)
15) M. Sc. II year Applied Mathematics
16) M. Sc. II year Mathematics
17) M. Sc. II year Mathematics (Campus)
18) M. Sc. II year Microbiology
19) M. Sc. II year Microbiology (Campus)
20) M. Sc. II year Statistics
21) M. Sc. II year Statistics (Campus)

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.:शै–१/एनइपी/विवत्रंविपदवी/२०२४–२५/१०९
दिनांक १२.०६.२०२४

डॉ. सरिता लोसरवार
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत : १) मा. आधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मुंल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
३) मा. प्राचार्य, सर्व संबधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) मा. संचालक, सर्व संकुले परिसर व उपपरिसर, प्रस्तुत विद्यापीठ
५) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, सदर परिपत्रक संकेतस्थळावर प्रसिध्द करण्यात यावे.

SWAMI RAMANAND TEERTH

MARATHWADA UNIVERSITY, NANDED - 431 606

STRUCTURE AND SYLLABUS OF

TWO YEAR MASTERS PROGRAMME

FOR

AFFILIATED COLLEGES

Subject -**Environmental Science**

Under the Faculty of
Science and Technology

Effective from Academic year 2023 – 2024
(As per NEP-2020)

Forward by the Dean, Faculty of Science and Technology

Introduction:

The National Education Policy 2020 (NEP 2020) is formulated to revamp education system and lay down road map for new India. This policy is framed based on the fundamental pillars of access, equity, quality, affordability, and accountability and seeks to transform India into a thriving knowledge society and a global knowledge superpower.

Some of the important features of National Education Policy are Increasing GER in higher education, Holistic and multidisciplinary education with multiple entry/exit options, Establishment of academic bank of credit, Setting up of multidisciplinary education and research Universities and National Research Foundation, Expansion of open and distance learning to increase gross enrolment ratio, Internationalization of education, Motivated, energized and capable faculty, Online and digital education and Effective governance and leadership.

As per the National Education Policy, the Government of Maharashtra has proposed a model curriculum framework and an implementation plan for the State of Maharashtra. It is to suggest and facilitate the implementation of schemes and programs, which improve not only the level of academic excellence but also improve the academic and research environment in the state. The proposed curriculum framework endeavours to empower the students and help them in their pursuit for achieving overall excellence.

In view of NEP priority and in-keeping with its vision and mission, process of updating the curriculum is initiated and implemented in SRTM University at UG and PG level from the academic year 2023-2024.

Keeping in mind, BOS in Environmental and Earth Science has prepared the curriculum to ensure up-to-date level of understanding of Environmental Science. Studying Environmental Science prepares the students for their career working either in educational institutions or industries in which they can be directly involved in the teaching, research and development. Also, to ensure uniform curriculum and its quality at PG level, curriculum of different Indian Universities, syllabus of NET, SET, MPSC, UPSC, and the UGC model curriculum are referred to serve as a base in updating the same.

The comments or suggestions from all teachers, students and other stakeholders are welcome for upbringing this curriculum.

Salient Features:

The syllabus of M Sc Environmental Science has been framed to meet the requirement of Choice Based Credit System under NEP 2020. The courses offered here in will train and orient the students in the specific fields of Environmental Science.

Core Courses deals with…

Apart from the Fundamental and applied Core Courses, the Discipline Specific Elective Courses deals with Water & Wastewater Treatment Technology, Applied Microbiology, Air Pollution etc.

This would help students to lay a strong foundation in the field of Environmental Science.

Overall, after completion of this course, students will also acquire fundamental knowledge and applications in Environmental Science and also understand that Environmental Science is an integral part of the human life and developments.

Program Educational Objectives:

The Objectives of this program are:

PEO1: To expose themselves to the diversity amongst life forms and their interactions.

PEO2: To make aware of natural resources and environment and the importance of conserving the same.

PEO3: To update curriculum by introducing recent advances in the subject and enable the students to face NET, SET, UPSC and other competitive examinations successfully.

PEO4: To train and orient the students so as to develop human resource for the educational institutes, industries and other organizations.

PEO5: To develop specific skills amongst students for self-employability through the development of their own enterprises.

PEO6: To develop ability for the application of the acquired knowledge in the fields of life so as to make our country self-reliant and self-sufficient.

Program Outcomes:

The Outcomes of this program are:

PO1: This program will expose the students to the diversity amongst different life forms.

PO2: This program shall also make aware the students about natural resources and environment and the importance of conserving the same.

PO3: This will provide updated curriculum with recent advances in the subject and enable the students to face NET, SET, UPSC and other competitive examinations successfully.

PO4: This program shall train and orient the students so as to develop human resource for the educational institutes, industries and other organizations.

PO5: This will also develop specific skills amongst students for self-employability through the development of their own enterprises.

PO6: This shall develop ability in the students for the application of the acquired knowledge in the fields of life so as to make our country self-reliant and self-sufficient.

Prerequisite:

The students seeking admission to M Sc Environmental Science should have passed Graduation in sciences. The optional courses are offered to the students registered for graduate and post-graduate

programs. Such students should have the basic knowledge of Environmental Science and willing to gain additional knowledge in the field of Environmental Science.

Admissions to this program are given as per the University rules.

Dr. Vasant Wagh

Chairman, BOS Environmental & Earth Science

Swami Ramanand Teerth Marathwada University, Nanded.

wagh.vasant@gmail.com

Details of the Board of Studies Members in the subject Environmental Science under the faculty of Science & Technology of S.R.T.M. University, Nanded

Dr. Vasant Madhav Wagh **Chairman** School of Earth Sciences, Swami Ramanand Teerth Marathwada University, Nanded 431606.	**Dr. Sudhir Vishwambhar Shivanikar** **Member** Netaji Subhashchandra Bose College, Nanded
Dr. Raju Kashinath Narkhede **Member** Maharashtra Udaygiri Mahavidyalaya, Udgir, Tq. Udgir Dist. Latur	**Dr. Kedar Ramkrishna Solunke** **Member** Indira Gandhi Senior College, CIDCO, Nanded
Dr. Vinod K Mukke **Member** Shivneri Mahavidyalaya, Shirur Anantpal, Tq. Shirur Anantpal Dist. Latur	**Dr. Jayprakash Manoharrao Patwari** **Member** Maharashtra Udaygiri Mahavidyalaya, Udgir, Tq. Udgir Dist. Latur
Dr. Rajkumar Govindrao Pawale **Member** Indira Gandhi Senior College, CIDCO, Nanded	**Dr. Satish Sudhakarrao Patil** **Member** Dr. B A Marathwada University, Aurangabad (Chh. Sambhajinagar)
Dr. Ravindra S. Gavali **Member** Centre for Natural Resource Management, (CNRMCC & DM) National Institute of Rural Development & Panchayati Raj, Rajendra Nagar, Hyderabad	**Dr. Pravin U. Meshram** **Member** Sevadal Mahila Mahavidyalaya & Research Academy, Sakkardara Square, Umrer Road, Nagpur-440009
As Per MPUA u/s 40(2)(d)(E) Invitee Member 2023 UG and PG Students	
Shaikh Humedsalman Shaikh Aminullah C/o Yeshwant Mahavidyalaya, Nanded	**Maniyar Fatema Ismail** C/o Maharashtra Udaygiri Mahavidyalaya, Udgir, Tq. Udgir Dist. Latur

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science & Technology

Credit Framework for Two Year PG Program

Subject: Environmental Science

Year & Level 1	Sem. 2	Major Subject (DSC) 3	Major Subject (DSE) 4	RM 5	OJT / FP 6	Research Project 7	Practicals 8	Credits 9	Total Credits 10
1	1	SENVCT1401 Environmental Biotechnology **(4 Cr)** SENVCT1402 Natural Resource Management **(4 Cr)** SENVCT403 Environmental Analytical Techniques **(12 Cr)**	SENVET1401 Indian Environment (3 Cr) SENVEP1401 Indian Environment (1 Cr) OR SENVET1402 Sustainable Agriculture & OrganicFarming (3 Cr) SENVEP1402 Sustainable Agriculture & OrganicFarming (1 Cr) **(4 Cr)**	**SENVRM1401** *Research Methodology* **(3 Cr)**	--		SENVCP1401 Environmental Biotechnology (1Cr) SENVCP1402 Natural Resource Management (1Cr) SENVCP1403 Environmental Analytical Techniques (1Cr) **(3 Cr)**	**22**	**44**
	2	SENVCT1451 Green Technology **(4 Cr)** SENVCT1452 Applied Microbiology **(4 Cr)** SENVCT1453 Current Environmental Issues **(4 Cr)** **(12 Cr)**	SENVET1451 Disaster Management & Mitigation (3 Cr) SENVEP1451 Disaster Management & Mitigation (1 Cr) OR SENVET1452 Habitat and Wildlife: Conservation &Management (3 Cr) SENVEP1452 Habitat and Wildlife: Conservation &Management (1 Cr) **(4 Cr)**	---	**SENVOJ1451** **(3 Cr)**	--	SENVCP1451 Green Technology (1Cr) SENVCP1452 Applied Microbiology (1Cr) SENVCP1453 Current Environmental Issues (1Cr) **(3Cr)**	**22**	

Exit option: Exit Option with PG Diploma *(after 2024-25)*									
2	**3**	SENVCT1501 Environmental Pollution & Human Health (4 Cr) SENVCT1502 Natural Resource Management & sustainability (4 Cr) SENVCT1503 Systematics & Biogeography (4 Cr) **(12 Cr)**	SENVET1501 Environmental Policy & Legislation (2 Cr) SENVEP1501 Environmental Policy & Legislation (1Cr) (From same Department / School) **(3 Cr)**	--		Research Project **SENVRP1551 (4Cr)**	**SENVCP1501** Environmental Pollution & Human Health **(1 Cr)** **SENVCP1502** Natural Resource Management & sustainability **(1 Cr)** SENVCP1503 Systematics & Biogeography **(3 Cr)**	**22**	**44**
	4	SENVCT1551 Remote Sensing, Geographic Information System &Modelling (4 Cr) SENVCT1552 Industrial Safety & Health Management (4 Cr) **(8 Cr)**	SENVET1551 Industrial Pollution Control Technology (3 Cr) SENVEP1551 Industrial Pollution Control Technology (1 Cr) **(4 Cr)** (From same Department / School)	**SVECP 551** Publication Ethics **(2 Cr)**		Research Project **SENVRP1552** **(6 Cr)**	**SENVCP1551** Remote Sensing, Geographic Information System &Modelling **(1Cr)** **SENVCP1552** Industrial Safety & Health Management **(1Cr)** **(2 Cr)**	**22**	
Total Credits		**44**	**16**	**05**	**03**	**10**	**10**	**88**	

M. Sc. Second Year Semester III *(Level 6.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SENVCT1501**	Environmental Pollution & Human Health	04	--	**04**	04	--
	SENVCT1502	Natural Resource Management & Sustainability	04	--	**04**	04	--
	SENVCT1503	Systematics & Biogeography	04	--	**04**	04	--
Elective (DSE)	**SENVET1501**	Environmental Policy & Legislation	02	--	**02**	02	--
Research Project	**SVECRM1501**	Research Project	04	--	**04**	04	
DSC Practical	**SENVCP1501**	Practicals based on SENVCT1501	--	01	**01**	--	02
	SENVCP1502	Practicals based on SENVCT1502	--	01	**01**	--	02
	SENVCP1503	Practicals based on SENVCT1503	--	01	**01**	--	02
DSE Practical	**SENVEP1501**	Elective Lab **based on SENVET1501**	--	01	**01**	--	02
Total Credits			**18**	**04**	**22**	**18**	**08**

M. Sc. Second Year Semester III *(Level 6.5)*

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits of individual paper)

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Major	**SENVCT1501**	Environmental Pollution & Human Health	20	20	20	80	--	--	100
	SENVCT1502	Natural Resource Management & Sustainability	20	20	20	80	--	--	100
	SENVCT1503	Systematics & Biogeography	20	20	20	80	--	--	100
Elective (DSE)	**SENVET1501**	Environmental Policy & Legislation	10	10	10	40	--	--	50
Research Project	**SVECRM1501**	Research Project					--	--	150
DSE Practical	**SENVCP1501**	Practicals based on SENVCT1501	--	--	--	--	05	20	25
	SENVCP1502	Practicals based on SENVCT1502	--	--	--	--	05	20	25
	SENVCP1503	Practicals based on SENVCT1503	--	--	--	--	05	20	25
DSE Practical	**SENVEP1501**	Elective Lab **based on SENVET1501**	--	--	--	--	05	20	25

M. Sc. Second Year Semester IV *(Level 6.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SENVCT1551**	Remote Sensing, Geographic Information System &Modelling	04	--	**04**	04	--
	SENVCT1552	Industrial safety and health management	04	--	**04**	04	--
Elective (DSE)	**SENVET1551**	Industrial Pollution Control Technology	03	--	**03**	03	--
Publication Ethics	**SENVPE1551**	Publication Ethics	02	--	**02**	02	
Research Project	**SENVRP1551**	Research Project	06		**06**		
DSC Practical	**SENVCP1551**	Practicals based on SENVCT1551	--	01	**01**	--	02
	SENVCP1552	Practicals based on SENVCT1552	--	01	**01**	--	02
DSE Practical	**SENVEP1551**	Practicals based on **SENVET1551**	--	01	**01**	--	02
Total Credits			**19**	**03**	**22**	**13**	**08**

M. Sc. Second Year Semester IV *(Level 6.5)*

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits of individual paper)

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Major	**SENVCT1551**	Remote Sensing, Geographic Information System &Modelling	20	20	20	80	--	--	100
	SENVCT1552	Industrial safety and health management	20	20	20	80	--	--	100
Elective (DSE)	**SENVET1551**	Industrial Pollution Control Technology	15	15	15	60	--	--	75
Publication Ethics	**SENVPE1551**	Publication Ethics	10	10	10	40			50
Research Project	**SENVRP1551**	Research Project							150
DSC Practical	**SENVCP1551**	Practicals based on SENVCT1551	--	--	--	--	05	20	25
	SENVCP1552	Practicals based on SENVCT1552	--	--	--	--	05	20	25
DSE Practical	**SENVEP1551**	Practicals based on **SENVET1551**	--	--	--	--	05	20	25

M.Sc Second Year: Semester III

Course Details

SENVCT1501: Environmental Pollution & Human Health (4 Cr)

Course pre-requisite:

- This paper deals with different aspects of environmental contamination, which have adverse effects on human health

Course objectives:

- It will emphasis on understanding mechanisms of pollutants impacting human health by developing an understanding of different types of pollutants their sources and mitigation measures.
- The students will also be introduced to the concept of permissible limits & Standards

Course outcomes:

- Obtain the scientific knowledge about the various types of Environmental pollution.
- To know & understand the effect of Environmental pollution on human health
- Capacity to develop mitigation measures to combat with the challenges of Environmental pollution

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction & Chemistry of Pollutant**	**15**
	1.1	Definition of pollution; pollutants; classification of pollutants.	
	1.2	Solubility of pollutants (hydrophilic and lipophilic pollutants), transfer of pollutants within different mediums,	
	1.3	Concept of biotransformation and bioaccumulation	
	1.4	Concept of radioactivity, radioactive decay, and half-life of pollutants,	
2.0		**Air & Noise Pollution**	**15**
	2.1	Ambient air quality: monitoring and standards (National Ambient Air Quality Standards of India); air quality index;	
	2.2	Sources and types of pollutants (primary and secondary); smog (case study) indoor air pollution: sources and effects on human health	
	2.3	Effects of different pollutants on human health (NO_x, SO_x, PM, CO, CO_2, hydrocarbons, and VOCs) control measures	
	2.4	Noise pollution – sources, effect on communication, impacts on life forms and humans, control measures	
3.0		**Water pollution & Marine Pollution**	**15**
	3.1	Sources of surface and ground water pollution; water quality parameters and standards;	
	3.2	Organic waste and water pollution eutrophication; COD, BOD, DO	
	3.3	Effect of water contaminants on human health (nitrate, fluoride,	

		arsenic, chlorine, cadmium, mercury, pesticides) water borne diseases concept and working of effluent treatment plants (ETPs).	
	3.4	Sources of marine pollution; oil spill and its effects; coral reefs and their demise; coastal area management; existing challenges and management techniques	
4.0		**Soil pollution & Radioactive Pollution**	**15**
	4.1	Causes of soil pollution and degradation	
	4.2	Effects of soil pollution on environment	
	4.3	Vegetation and other life forms; control strategies.	
	4.4	Radioactive material & sources of radioactive pollution; effect of radiation on human health (somatic and genetic effects);	
		Total	**60**

Text Books:

- **Air Pollution:** M. *N. Rao, (Tata McGraw- Hill publishing company. New Delhi)*
- **Air Pollution:** B.K. Sharma, H. Kaur *(Krishna Prakashan media, Meerut)*
- **Air Pollution:** V.P. Kudesia *(Pragati Prakashan, Meerut)*
- **Air Pollution:** B.K. Sharma, H. Kaur *(Krishna Prakashan media, Meerut)*
- **Air Pollution:** S.K. Agarwal *(A.P.H. Publishing Corporation, New Delhi)*
- **Environmental Chemistry:** A.K. De *(Wiley eastern limited, New Delhi)*
- **Water Pollution:** V.P. Kudesia *(Pragati Prakashan, Meerut)*
- **Water Supply & sanitary Engineering:** R.C. Rangwala and S.C. Rangwala *(Charotal publishing house, Anand)*
- **Principles of Environmental Biology:***P. K. G. Nair (Himalaya Publishing House, New Delhi.*
- **Environmental Biology:***M. P. Arora (Himalaya Publishing House, New Delhi)*
- **Environmental Science:***Enger Smith, Smith, W. M. C. Brown (Company Publishing)*
- **Introduction to Environmental Studies:***Turk & Turk*
- **Conservation of Natural resources:***David A. Castillan*
- **Fundamentals of Environmental Science:** *G. S. Dahliwal, G. S. Sangha, P. K. ralhan, Kalyani Publishers, New Delhi*
- **Environmental chemistry:** B. K. Sharma (Goel publishing house, Meerut)

Reference Books:

- Gurjar, B.R., Molina, L.T. & Ojha C.S.P. 2010. *Air Pollution: Health and Environmental Impacts*. CRC Press, Taylor & Francis.
- Hester, R.E. & Harrison, R.M. 1998. *Air Pollution and Health*. The Royal Society of Chemistry, UK.
- Park, K. 2015. *Park's Textbook of Preventive and Social Medicine* (23rd edition). Banarsidas Bhanot Publishers.
- Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2006. *Environmental and Pollution Science.* Elsevier Academic Press.
- Purohit, S.S. & Ranjan, R. 2007. *Ecology, Environment & Pollution*. Agrobios Publications.
- Vesilind, P.J., Peirce, J.J., & Weiner R.F. 1990. *Environmental Pollution and Control*. Butterworth-Heinemann, USA

SENVCP1501: Practicals based on (SENVCT1501) Environmental Pollution & Human Health (1 Cr)

1. Detection of SO2 from ambient air.
2. Detection of H2S from ambient air.
3. Detection of Ammonia from ambient air.
4. Determination of Air pollution index
5. Study of soil Pollution Index
6. Determination of water quality Index
7. Study of International & National Standards of Air Pollution
8. Study of International & National Standards of Water Pollution

SENVCT1502: Natural Resource Management and Sustainability (4 Cr)

Course pre-requisite:

- This paper takes an objective view of the nature of Earth's resources, their generation, extraction and impact of human activities on earth's environment.

Course objectives:

- To provide an idea of effective management strategies and a critical insight of the major sustainability issues

Course outcomes:

- The students are expected to understand effective management strategies. 01. Acquire knowledge about the various natural resources, their uses and management
- The importance of resource management to achieve the goals of sustainability.
- Provide opportunity to think on linkage between resources in environment and process of development

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction**	**15**
	1.1	Resource and reserves; classification of natural resources; renewable and non-renewable resources	
	1.2	Resource degradation; resource conservation; resource availability and factors influencing its availability	
	1.3	Land resources; water resources; fisheries and other marine resources; energy resources; mineral resources	
	1.4	Human impact on natural resources; ecological, social and economic dimension of resource management	
2. 0		**Natural Resources and Conservation**	**15**
	2.1	Forest resources: economic and ecological importance of forests, forest management strategies, sustainable forestry	
	2.2	Water resources: supply, renewal, and use of water resources, freshwater shortages, strategies of water conservation	
	2.3	Soil resources: importance of soil, soil conservation strategies	
	2.4	Food resources: world food problem, techniques to increase world food production, green revolution.	
3.0		**Non-Renewable Energy Resources**	**15**
	3.1	Oil: formation, exploration, extraction and processing, oil shale, tar sands	
	3.2	Natural gas: exploration, liquefied petroleum gas, liquefied	

		natural gas	
	3.3	Coal: reserves, classification, formation, extraction, processing, coal gasification	
	3.4	Environmental impacts of non-renewable energy consumption; impact of energy consumption on global economy	
4.0		**Renewable Energy Resources**	
	4.1	Solar energy: technology, advantages, passive and active solar heating system, solar thermal systems, solar cells, JNN solar mission	**15**
	4.2	Hydropower: technology, potential, operational costs, benefits of hydropower development	
	4.3	Nuclear power: nuclear fission, fusion, reactors, pros and cons of nuclear power, storage of radioactive waste, radioactive contamination	
	4.4	Tidal energy; wave energy; ocean thermal energy conversion (OTEC); geothermal energy	
		Total	**60**

Text Books/References:

- **Principles of Ecology:**P. S. Verma, V. K. Agarwal (S. Chand and Co. New Delhi
- **Environmental Management:**Sandeep Joshi (shrishti Eco – Research Institute, Pune)
- **Environmental Biology:**P. D. sharma (Rastogi Publications, Meerut)
- **Ecology and Environment:**P. D. sharma (Rastogi Publications, Meerut)
- **Principles of Environmental Biology:**P. K. G. Nair (Himalaya Publishing House, New Delhi.
- **Environmental Biology:**M. P. Arora (Himalaya Publishing House, New Delhi)
- **Environmental Science:**Enger Smith, Smith, W. M. C. Brown (Company Publishing)
- **Introduction to Environmental Studies:**Turk & Turk
- **Conservation of Natural resources:**David A. Castillan
- **Fundamentals of Environmental Science :** G. S. Dahliwal, G. S. Sangha, P. K. ralhan, Kalyani Publishers, New Delhi
- **Environmental chemistry:** B. K. Sharma (Goel publishing house, Meerut)
- **Environmental Science:**Enger Smith, Smith, W. M. C. Brown (Company Publishing)
- **Forests in India:** V. P. Agrawal Oxford & IBH Publishing company Pvt. Ltd., New Delhi), 1988
- **Plant ecology and Soil Science:** R. S. Shukla, P. S.Chandel , (S. Chand and company Ltd., New Delhi), 2001.
- **Textbook of Environmental Studies for Undergraduate Courses:** Erach Bharucha (Universities Press), 2013.
- **Introduction to Environmental Science:**Y. Anjaneyulu (B.S. Publication), 2008.
- **Environmental Science:** UGC NET/SET (Danika Publishing Company), 2018.

SENVCP1502: Practicals based on (SENVCT1502) Natural Resource Management and Sustainability (1 Cr)

01. Estimation of power requirements of a house/institute.
02. Familiarization with renewable energy gadgets
03. To study biogas plants
04. To study the production process of biodiesel
05. Familiarization with different solar energy gadgets
06. To study solar cooker
07. To study solar distillation
08. To study types of Coal
09. Visit to Natural water source / National Park / Wild life Sanctuary / Social Forestry Project / Forest or Wildlife Department
10. To prepare field Project Report

SENVCT1503: Systematics and Bio-geography (4 Cr)

Course pre-requisite:

- Basic understanding and interest about biodiversity and Taxonomy.

Course objectives:

- Students learn the nomenclature of the flora and fauna.
- Students will know about the extinction of plant an animal.
- Students come to know about habitat and its degradation.

Course outcomes:

- Students will able to know about principles and applications of classical and modern-day systematics to classification of living organisms
- Students will develop understanding of historical and contemporary patterns of distributions of organisms
- Will design effective conservation strategies using biogeographic theories in an era of global change and large scale human induced degradation.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Concept and Systematics Approaches**	**15**
	1.1	Definition of systematics; taxonomic identification; keys	
	1.2	Field inventory; herbarium; museum; botanical gardens; taxonomic literature; nomenclature.	
	1.3	Evidence from anatomy, palynology.	
	1.4	Numerical and molecular methods.	
2.0		**Taxonomic hierarchy**	**15**
	2.1	Concept of taxa (species, genus, family, order, class, phylum, kingdom)	
	2.2	Concept of species (taxonomic, typological, biological, evolutionary, phylogenetic)	
	2.3	Categories and taxonomic hierarchy.	
	2.4	Principles and rules of International Code of Botanical and Zoological Nomenclature)	
3.0		**Introduction to Biogeography**	**15**
	3.1	Genes as unit of evolutionary change; mutation; genetic drift; gene flow; natural selection	
	3.2	Geographic and ecological variation;	
	3.3	Biogeographical rules – Gloger's rule, Bergmann's rule	
	3.4	Allen's rule, Geist rule etc	

4.0		**Ecological Biogeography**	**15**
	4.1	Species' habitats; environment and niche concepts.	
	4.2	biotic and abiotic determinants of communities; species-area relationships.	
	4.3	concept of rarity and commonness; Island Biogeography theory.	
	4.4	Equilibrium Theory of Insular Biogeography; geography of diversification and invasion; phylogeography. Case studies etc	
		Total	**60**

Text Books:

- Lomolino, M.V., Riddle, B.R., Whittaker, R.J. & Brown, J.H. 2010. *Biogeography* (4th edition). Sinauer Associates, Sunderland.
- Mani, M.S. 1974. *Ecology and Biogeography in India*. Dr. W Junk Publishers., The Hague.
- Singh, G. 2012. *Plant Systematics: Theory and Practice* (3rd edition). Oxford & IBH Pvt. Ltd., New Delhi.

Reference Books:

- Wheeler, Q.D. & Meier R. 2000. *Species Concepts and Phylogenetic Theory: A Debate.* Columbia University Press, New York.
- Williams, D. M., Ebach, M.C. 2008. *Foundations of Systematics and Biogeography*. Springer.
- Wilkins, J. S. 2009. *Species: A History of the Idea* (Vol. 1). University of California Press.

SENVCP1503: Practicals based on (SENVCT1503) Systematics and biogeography (1 Cr)

1. Prepare a herbarium sheet.
2. Study botanical garden in your campus and identify the flora and fauna.
3. Visit to a museum.
4. Visit to terrestrial ecosystem.
5. study of rare species.
6. Assessment of biodiversity of terrestrial area
7. Wildlife management: Protected Areas of India. National Parks and Wild Life Sanctuaries. Community Conservation Areas.
8. Major wildlife habitats and conservation areas in India
9. Preparation of report on biodiversity/wildlife

SENVET1501: Environmental policy and legislation (2 credits)

Course pre-requisite:

- This course may opt by students to understand the environmental management plan/legislations for protection of natural resources.
- To understand the EIA process and their role in developmental projects and conservation

Course objectives:

- The aim of this paper is to provide skills and an improved understanding of how firms and organisations work with sustainability issues such as environmental and natural resource management and sustainability issues.
- To know the environmental legislation and their operations at national level.
- To understand the EIA process and their role in developmental projects.
- To apply monitoring and environmental management tools used by resource and environmental practitioners.
- To consider the impacts of flows (energy, water, resources/waste) within the built, urban, agricultural and natural environments.

Course outcomes:

- Analyze and interpret the environmental problems at national and international level.
- Students are able to compare the different roles of, and relations between, firms, governmental agencies, NGO‘s in relation to issues concerning environmental and natural resource management and sustainability.
- It is important to predict the environmental impacts of developmental projects and engineered solutions in global and socio-economic context.
- Students are able to think critically and contribute to research in solving contemporary environmental problems with professional and ethical accountability

Curriculum Details:

IoduleNo.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction of Environmental Management**	**08**
	1.1	Environmental management Plan (EMP). Objectives and Components.	
	1.2	Pollution abatement strategies: A basis for Preventive Environmental Policy (PEP). Environmental Management System Standards (ISO 9001, ISO14000 series etc),	
	1.3	Environmental Audit, Global Environmental Policies. The Agenda 21 of Earth Summit etc	
	1.4	Stockholm Conference on Human Environment 1972, Montreal Protocol, 1987, Ramsar Convention on Wetlands (1971), Earth Summit at Rio de Janeiro, 1992, etc	
2.0		**Environmental policy and planning**	**07**
	2.1	Clean Development Mechanism (CDM), Earth Summit at Johannesburg, 2002 etc	

	2.2	IPCC, UNEP, IGBP. Environmental Protection Efforts at National Level.	
	2.3	National Forest Policy, 1988, National Water Policy, 2002	
	2.4	National Environmental Policy, 2006 etc	
3.0		**Environmental Legislation**	
	3.1	Basic Concepts and Principles; History of Environmental Legislation;	
	3.2	Environmental Acts and Policies, Scope for improvement; National Environmental Policy Act, Environmental Tribunal;	
	3.3	Role of Central Pollution Control Board and State Pollution Control Boards. Water pollution Act (1974); The Air pollution Act (1981); Environmental Protection Act (1986).	**08**
	3.4	Conservation of Biodiversity Act (1999); Wild Life Protection Act (1972); Forest Conservation Act, 1980, Coastal Regulation Zones (CRZ) 1991 etc.	
4.0		**Environmental Impact Assessment (EIA)**	
	4.1	Environmental Impact Assessment (EIA), Aims and objectives Procedure for reviewing EIA of developmental projects.	
	4.2	Life-cycle analysis, cost-benefit analysis, Guidelines for Environmental Audit.	
	4.3	EIA Check lists, Matrix & Network methods for EIA. Prediction of short- & long-term impacts on environment (physical, biological & socio culture).	**07**
	4.4	Public Participation, Methodology and approach for public participation, Regulatory requirements, Advantages and disadvantages of Public participation, EIA Notification 1994, Case studies related EIA.	
		Total	**30**

Text books:

- Environmental Law & Policy in India: Divan S & Rosencraz A,Oxford Uni Press, New Delhi, 2001
- Environmental Laws of India-An Intro: CPR Environmental Education Centre, Chennai, 2001
- Conservation & Environmentalism-An Encyclopedia: Paehlka R. Garland Pub Inc. New York, 1995.
- Environmental Awareness & Education: V. P. Kudesia, Educational Publishers, Meerut U.P.
- Biodiversity: V. P. Kudesia, Educational Publishers, Meerut, U.P.
- Our Environment and Green Revolution: M. P. Mishra, S.Chand & Co.Ltd.New Delhi, 2000
- Environmental Concerns & Strategies: T. N. Khoshoo.
- Environmental Management in India: R. K. Sapru.
- Forests in India: V. P. Agrawal, Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi, 1968
- Introduction to Social Forestry: Sitram Rao, Oxford and IBH Pub. Co. Pvt. Ltd
- An Introduction to Environmental Management: Dr. Anand S. Bal, Himalaya Pub House, 2005

Reference Books:

- Environmental Law & Policy in India: Divan S & Rosencraz A,Oxford Uni Press, New Delhi, 2001
- Conservation & Environmentalism-An Encyclopedia: Paehlka R. Garland Pub Inc.New York, 1995
- Environmental Awareness & Education: V. P. Kudesia, Educational Publishers,Meerut U.P.
- Biodiversity: V. P. Kudesia, Educational Publishers, Meerut, U.P.
- Our Environment and Green Revolution: M. P. Mishra, S.Chand & Co.Ltd.New Delhi, 2000
- Environmental Concerns & Strategies: T. N. Khoshoo.
- Environmental Management in India: R. K. Sapru.
- Forests in India: V. P. Agrawal, Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi, 1968
- Environmental Impact Assessment: R.R. Barthwal
- An Introduction to Environmental Management: Dr. Anand S. Bal, Himalaya Pub House, 2005.
- Environmental Management; N. K. Uberoi, Excel publication new Delhi. 2ndedition.

SENVEP1501: Practical Based on (SENVET1501) Environmental management and EIA (1 credit)

1. To prepare EIA report of Highway Construction
2. To prepare EIA report of Mining
3. Project on Eco-tourism.
4. To study ISO 14000 accreditation procedures
5. Preparation of DMP for nuclear power plant, petrochemical industry, fertilizer plant, hydro power station, chemical industry, thermal power plant, textile mill, metallurgical industry.
6. To study case studies related to Environmental Laws
7. To study case studies related to EIA
8. To study Pollution abatement strategies
9. To study case studies related to EMP
10. Field Visit

M.Sc Second Year: Semester IV

Course Details

SENVCT1551: Remote Sensing GIS and Modelling (4 credits)

Course pre-requisite:

- Student can learn the applications of GIS and RS in Environment.

Course objectives:

- To provide exposure to students in gaining knowledge on concepts and applications leading to modelling of earth resources management using Remote Sensing.
- To acquire skills in storing, managing digital data for planning and development.
- To acquire skills in advance techniques in Remote Sensing for mapping, modelling and monitoring.

Course outcomes:

- On completion of this course, the student shall be able to
- Understand concepts of passive and active microwave system
- Acquire skills in handling instruments, tools, techniques and modelling while using Remote Sensing Technology.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Fundamental of Remote Sensing**	**15**
	1.1	Definition and Overview of Remote Sensing, History and Evolution of Remote Sensing, Remote Sensing Systems	
	1.2	Energy: Sources of energy, Energy radiation principle, Energy interaction in the atmosphere, Energy interactions with earth surface feature.	
	1.3	Recording energy by sensor transmission, Reception processing, Interpretation & Analysis.	
	1.4	Advantages of Remote sensing, limitation of Remote sensing, Ideal and Real Remote sensing.	
2.0		**Fundamental of Satellite Remote Sensing**	**15**
	2.1	Orbital characteristics of Remote sensing satellite, Concept of platforms and sensors.	
	2.2	Remote Sensing systems, Types of sensors.	
	2.3	Resolution of sensors—spatial, spectral, radiometric and temporal.	
	2.4	Different application with respect to earth surface feature	

3.0		**Fundamental of G.I.S**	
	3.1	Basic Concepts: definition of GIS, Components of GIS, Variables - points, lines, polygon, Functionality of GIS, Areas of GIS application, Advantage and Limitation of GIS	**15**
	3.2	GIS Data: Spatial and Attribute Data, Information Organization and Data Structures - Raster and Vector data structures, Data file and database, Creating GIS Database: GIS Softwares, file organization and formats, Geo-database, Rectification,	
	3.3	Digitization and Map Composition. GIS Data Input: Nature and Source of data, Method of spatial data capture - Primary and Secondary data.	
	3.4	Digitization and scanning method, Techniques and procedure for digitizing, Errors of Digitization, Attribute data capture	
4.0		**Modelling**	
	4.1	Application of Geo-informatics in Environmental issues, Measurement of Canopy Cover through Leaf Area Index (LAI) Meter, Runoff & Soil Loss estimation based on empirical models.	**15**
	4.2	Morphometric analysis of terrain, satellite image-based hydro-geomorphological interpretation for ground water targeting.	
	4.3	Swat models. Global Positioning system (GPS).	
	4.4	Digital terrain models for selection of dam site, road, and canal construction, Cut & Fill analysis using DEM	
		Total	**60**

Text Books:

- Remote Sensing and Image interpretation: Thomas Lille sand & R.W. Keifer, John Wiley and Sons (3rd Ed.).
- Text Book of Remote Sensing & Cartography Kalyani Publication, D. Nandi, T. Chattrejee. Singh, G. 2012.
- Panda, B. C., 2008. Remote Sensing: Principles and Applications, Viva Books Private Limited, India
- C.P.Lo and Albert K.W.Yeung 2005 “Concepts and Techniques of Geographic Information Systems” Prentice Hall of India,New Delhi.
- 4. Chakraborty and Sahoo, 2008, Fundamentals of Geographic Information Systems, Viva Books Private Limited, India.
- Jensen J.R. (2007) Remote Sensing of the Environment: An Earth Resource Perspective, 2nd ed., Prentice Hall.

Reference Books:

- John, R. J., Introductory Digital Image Processing – A Remote Sensing Perspective, Prentice Hall Series.
- Muralikrishna V., Geographical Information Systems and Remote Sensing Applications, Allied Publishers Private Limited.

- Nag P. and Kudrat M., Digital Remote Sensing, New Delhi, Concept Publishing.
- Reeves, Robert G., "Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA.
- Richards J.A. and Jia X. (2006) Remote Sensing Digital Image Analysis: An Introduction, 4th ed., Springer.
- P.S. Roy (2000). Natural Disaster and their mitigation. Published by Indian Institute of Remote Sensing (IIRS), 2000.
- Schultz, G. A. and Engman, E. T. 2000. Remote Sensing in Hydrology and Water Management, Springer-Verlag, Berlin, Germany.

SENVCP1551: Practical based on (SENVCT1551) Remote Sensing GIS and Modelling (1 credits)

1. To study the Toposheet.
2. To load image and display.
3. To generate vector boundary.
4. Study of Basic commands of GIS.
5. Hands on training on free software's of GIS.
6. Hands on training on GPS.
7. Digital elevation model generation via point interpolation techniques and interpolation of contour lines.

SENVCT1552: Industrial Safety & Health Management (4 Cr)

Course pre-requisite:

- This course may opt by any students from any discipline to understand the personal/occupational safety and avail better placement opportunity in the industries.

Course objectives:

- The aim of this paper is to provide skills and an improved understanding of how industries work with health issues.
- To know the occupational and health safety in industrial environment and their operations.
- Students can acquire sound knowledge about personal/occupational health, industrial hygiene, and accidental prevention methods

Course outcomes:

- Analyze and interpret the occupational health safety and importance personal health during industrial work
- It is help to develop an expert manpower to handle the complex environment in the industrial process.
- It is important to predict the environmental impacts of developmental projects and engineered solutions in global and socio-economic context.

Curriculum Details:

ModuleNo.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Industrial Safety**	**15**
	1.1	Personal/ Occupational Safety, Health and Environmental Safety, Industrial safety management – principles & practices, Management role in Industrial Safety, Organization role towards workers.	
	1.2	Protective equipment, planning for Safety, Health and Management,	
	1.3	Pre-employment, periodic medical examination of workers, medical surveillance for control of occupational diseases and health records.	
	1.4	WHO/ILO/ EPA guidelines for personal health	
2.0		**Monitoring for Safety, Health & Environment**	**15**
	2.1	Definition of Industrial Hygiene, Industrial Hygiene: Control Methods, Substitution, Changing the process, Local Exhaust Ventilation, Isolation, Wet method,	
	2.2	Personal hygiene, housekeeping and maintenance, waste disposal, special control measures.	
	2.3	Chemical Hazard: Introduction to chemical hazards, dangerous properties of Chemical, Dust, Gases, Fumes, Mist, Vapors, Smoke	

		and Aerosols.	
	2.4	concepts of dose response relationship, bio-chemical action of toxic substances. Concept of threshold limits values. - 1998 and 15001 – 2000, OSHA, Process Safety Management (PSM) as per OSHA,	
3.0		**Training Programs**	
	3.1	Techniques of training, design and development of training programs. Training methods and strategies types of training. Evaluation and review of training programs Bureau of Indian standards on safety and health 14489-1998 and 15001 – 2000	**15**
	3.2	OSHA, Process Safety Management (PSM) as per OSHA, PSM principles, OHSAS – 18001,	
	3.3	EPA Standards, Importance of Industrial safety,	
	3.4	Role of safety department, Safety committee and function.	
4.0		**Industrial Safety management**	
	4.1	Safety Management, Objectives of Safety management, National safety Council, Safety acts and Provisions for workers welfare,	
	4.2	Principles of Safety management, Safety Organization, Management's safety policy, Responsibilities of Management for safety in plant,	**15**
	4.3	Safety and housekeeping; Industrial fire management: Fundamentals of fire, Elements of fire, Classification of fires, Common causes of industrial fires,	
	4.4	Fire–Extinguishing Techniques, Fire–Extinguishing agents and applications, Fire protection & Fire fighting	
		Total	**60**

Text/Reference Books

- Metcalf & Eddy, Inc., Wastewater Engineering: Treatment and Reuse, 4th edn., Tata McGraw Hill, New Delhi, 2003.
- Modi, P. N., Sewage Treatment and Disposal and Waste Water Engg, Vol. II, Std Book House, Delhi.
- Peavy, H. S., Rowe, D. R, Tchobanoglous, G, Environmental Engineering; McGraw Hill, 1995.
- De Nevers, N, Air Pollution Control Engineering, 2nd edn., McGraw-Hill, 2000.
- Bhatia S C, Environmental Pollution and Control in Chemical Process Industries, Khanna Pub, Delhi.
- Mahajan, S. P, Pollution Control in Process Industries, Tata McGraw-Hill, New Delhi, 1998.
- Masters, G. M, Introduction to Environmental Engineering and Science, Prentice Hall off India, (2008).
- Rao C S, Environmental Pollution Control Engineering, Wiley Eastern (2010). 9. S C Santra, Environmental Science.

SENVCP1552: Practical Based on (SENVCT1552) (1 credit)

1) Introduction to Industrial pollution
2) To identify and classify sources of pollution
3) To study industrial sampling.
4) Types of fire extinguishers used in Industrial safety
5) Use of personal protective equipments in industrial safety
   (Rubber and Leather Gloves, Helmet, Safety shoes, welding apron, breathing apparatus etc.)
6) Case Studies
7) Field Visits

SENVET1551: Industrial Pollution Control Technology (3 Cr)

Course pre-requisite:

- It is essential to complete the course with 44 credits in First year of PG programme.

Course objectives:

- Focus on classification of air pollutants, water pollutants and solid waste –causes, effects and control methods, need of environmental Legislation.
- A basic understanding of the fundamentals of air pollution with a background on historical perspective on air pollution.
- Knowledge of major air pollutants; their sources and effects (environmental, economic and health), Sampling of air pollutants and their analysis
- The course is designed as tailor-made approach to know the fundamental concepts and various technologies of industrial wastes and solid waste management.

Course outcomes:

- Enables the students to adopt the preventive measures for the control of air pollutants, waste water treatment methods, and solid waste management methods in domestic, municipal waste.
- Enables the students to understand the control measures of pollutants emitted from different industries like Paper and pulp, fertilizer, sugar and alcohol, petrochemical and petroleum refinery, pharmaceutical and metal finishing industries.
- Enables the student to learn the sampling and analysis of pollutants (Monitoring of air pollutants)
- Enables student to gain knowledge about various technologies available to control of specific air pollutants like So2, NOx , organic vapors etc.
- On completion of the subject course, the students will have the scope to learn various theoretical and technical aspects of industries waste water treatment and solid waste management methods which are very significant in industrial sector.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Air pollution control technology-I:**	
	1.1	Introduction of air pollution, Air pollution control techniques.	**12**
	1.2	Particulate emission control: Gravity settlers, Wet scrubbers, solid traps,	
	1.3	Cyclone separators, fabric filters etc.	
	1.4	Scrubbers and electro-static precipitators.	
2.0		**Air pollution control technology-II:**	
	2.1	Gaseous emission control: Principles of absorption and adsorption;	**12**
	2.2	Packed towers, Plate towers, Spray towers, Odor control: Combustion.	
	2.3	Removal methods: removal of Sulfur dioxide, Nitrogen oxides, Hydrocarbons.	
	2.4	Industrial stack/chimney design, wind rose, meteorological parameters etc.	
3.0		**Solid waste disposal methods**	
	3.1	Solid waste disposal, land filling, sanitary landfilling	**12**
	3.2	Waste minimization, disposal in to sea, mechanical compost plant	
	3.3	pulverization, trenching; disposal	
	3.4	Composting, incineration, pyrolysis	
4.0		**Water pollution control methods**	
	4.1	Primary treatment: Screens; Grit chambers; Detritus tank, Skimming tank; Sedimentation:	**09**
	4.2	Secondary treatment: Aerobic Treatment: Activated sludge process, aeration tank, Trickling filters,	
	4.3	Anaerobic treatment: Septic tank; Imhoff tank; Sludge digestion tank.	
	4.4	Tertiary treatment: Disinfection	
		Total	

Text Books:

- Environmental Pollution Control Engineering by C. S. Rao. Wiley Eastern Limited
- Waste Water Treatment: Rational Methods of design and industrial practices by M. Narayana Rao and Amal K. Datta. Oxford & IBH publishing Co. Pvt. Ltd.
- Environmental Biotechnology: Basic concepts and applications by Indu Shekhar Thakur. 1. K. International Pvt. Ltd...
- A Text book of Sanitary Engineering: Vinayak Gharpure (Engineering Book Publishing Company, Pune)

Reference Books:

- Name Authors (as appeared on book), "Title of reference Book", Vol…, Edition, Name of Publisher, Year of Publications

- Design of Pollution Control Equipment' by Gregory Sincero and Adam Sincero 'Air Pollution' by H.V.N. Rao, Mc Graw Hill Publications, 1998.
- Waste water treatment for pollution control: Soli J. Arceivala (Tata Mc-Grew Hill Publishing Company, New Delhi)
- Water supply and sanitary engineering: R. C. Rangwala and S. C. Rangwala (Charotal publishing house, Anand)
- Waste water treatment: M. N. Rao, A. K. Datta (Oxford and IBH publishing company, New Delhi)
- Water Pollution: V. P. Kudesia (Pragati Prakashan, Meerut)
- Environmental Chemistry: B. K. Sharma (Goel Publishing House, Meerut).
- Waste water Engineering: Metcalf and Eddy (Tata Mc-Grew Hill Publishing Company, New Delhi).
- Water Pollution and disposal of Waste water on Land : U. N. Mahida (Tata Mc-Grew Hill Publishing Company, New Delhi)

SENVEP1551: Practicals based on (SENVET1551) Industrial Pollution Control Technology (1 Cr)

1. Determination of Silica.
2. Determination of Ammonia from sewage sample.
3. Determination of Nitrates from sewage sample.
4. Estimation of hydrogen Sulphide from the wastewater.
5. Estimation of Biochemical oxygen demand of wastewater.
6. Estimation of Chemical oxygen demand waste water
7. Detection of SO2 from ambient air.
8. Detection of H2S from ambient air.
9. Determination of Suspended Particulate Matter by HVAS.
10. Determination of Respirable Suspended Particulate Matter by HVAS.

Guidelines for Course Assessment:

A. Continuous Assessment (CA) (20% of the Maximum Marks):

This will form 20% of the Maximum Marks and will be carried out throughout the semester. It may be done by conducting **Two Tests** (Test I on 40% curriculum) and **Test II** (remaining 40% syllabus). Average of the marks scored by a student in these two tests of the theory paper will make his **CA** score (col. 6).

B. End Semester Assessment (80% of the Maximum Marks):

(For illustration we have considered a paper of 04 credits, 100 marks and need to be modified depending upon credits of an individual paper)

1. **ESA Question paper will consists of 6 questions, each of 20 marks.**
2. **Students are required to solve a total of 4 Questions.**
3. **Question No.1 will be compulsory and shall be based on entire syllabus.**
4. Students need to solve **ANY THREE** of the remaining Five Questions (Q.2 to Q.6) and shall be based on entire syllabus.

Note: **Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. One credit of theory corresponds to 15 Hours lecturing and for practical course one credit corresponds to 30 Hours. For example, for a course of two credits 30 lectures of one hour duration are assigned, while that for a three credit course 45lectures.**