॥ 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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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.

STRUCTURE AND SYLLABUS OF TWO-YEAR POST GRADUATE PROGRAM IN

SCIENCE & TECHNOLOGY

(R-2023)

UNDER

NATIONAL EDUCATION POLICY (NEP 2020)

In

SUBJECT: ENVIRONMENTAL SCIENCE

FACULTY OF SCIENCE AND TECHNOLOGY

Program Code: SES-S-ENV-PG

M. Sc. Second Year
UNIVERSITY CAMPUS

SCHOOL OF EARTH SCIENCES

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

With Effect from June 2023

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, 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 Sciences

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	SENVCT2401 Ecology and Evolution (4 Cr) Theory SENVCT2402 Air and Water Pollution (4 Cr) Theory SENVCT2403 Energy Resource Management (4 Cr) Theory **(12 Cr)**	SENVET2401 Environmental Geosciences (3 Cr) Theory SENVEP2401 Environmental Geosciences (1 Cr) Practical OR SENVET2402 Current Environmental Issues (3 Cr) Theory SENVEP2402 Current Environmental Issues (1 Cr) Practical **(4Cr)**	SENV**RM2401** *Research Methodology* **(3 Cr)**	--		SENVCP2401 Ecology and Evolution (1 Cr) Practical SENVCP2402 Air and Water Pollution (1 Cr) Practical SENVCP2403 Energy Resource Management (1 Cr) Practical **(3 Cr)**	**22**	**44**
	2	SENVCT2451 Environmental Chemistry and Toxicology (4 Cr) Theory SENVCT2452 Environmental Analytical Techniques	SENVET2451 Environmental Economics (3 Cr) Theory SENVEP2451 Environmental Economics	---	SENV**OJ2451** **(3 Cr)**	--	SENVCP2451 Environmental Chemistry and Toxicology (1Cr) Practical SENVCP2452 Environmental	**22**	

		(4 Cr) Theory SENVCT2453 Environmental Microbiology (4 Cr) Theory **(12 Cr)**	(1 Cr) Practical **OR** SENVET2452 Biodiversity and Wildlife Management (3 Cr) Theory SENVEP2452 Biodiversity and Wildlife Management (1 Cr) Practical **(4 Cr)**				Analytical techniques (1 Cr) Practical SENVCP2453 Environmental Microbiology (1 Cr) Practical **(3 Cr)**		
Exit option: Exit Option with PG Diploma *(after 2024-25)*									
2	**3**	SENVCT2501 Solid waste management (4 Cr) Theory SENVCT2502 Water and Wastewater Treatment Technology (4 Cr) Theory SENVCT2503 Remote sensing and Geographical Information System (4 Cr) Theory **(12 Cr)**	SENVET2501 Environmental Biotechnology (2 Cr) Theory SENVEP2501 Environmental Biotechnology (1 Cr) Practical **OR** SENVET2502 Computer applications in Environment (2 Cr) Theory SENVEP2502 Computer applications in Environment (1 Cr) Practical (***From same Department / School) 3 (cr)***	--		**SENVRP2501 (4Cr)** Research Project	SENVCP2501 Solid waste management (1 Cr) Practical SENVCP2502 Water and Wastewater Treatment technology (1 Cr) Practical SENVCP2503 Remote sensing and Geographical Information System (1 Cr) Practical **(3 Cr)**	**22**	**44**

	4	SENVCT2551 Industrial Pollution Control and Safety (4 Cr) Theory SENVCT2552 Environmental Management and EIA (4 Cr) Theory **(8 Cr)**	SENVET2551 Disaster Management (3 Cr) Theory SENVEP2551 Disaster Management (1 Cr) Practical **OR** SENVET2552 (3 Cr) Green technology Theory SENVEP2552 Green technology (1 Cr) Practical **(4 Cr)** (***From same Department / School)***	**S**ENV**PE2551** Publication Ethics (2 Cr)		**S**ENV**RP2551** **(6 Cr)** Research Project	SENVCP2551 Industrial Pollution Control and Safety (1 Cr) Practical SENVCP2552 Environmental, management and EIA (1 Cr) Practical **(2 Cr)**	**22**	
Total Credits		**44**	**15**	**05**	**03**	**10**	**11**	**88**	

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

Teaching Scheme

Subject	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SENVCT2501	Solid waste management	04	--	**04**	04	--
	SENVCT2502	Water and Wastewater Treatment Technology	04	--	**04**	04	--
	SENVCT2503	Remote sensing and Geographical Information System	04	--	**04**	04	--
Elective (DSE)	SENVET2501 OR SENVET2502	Environmental Biotechnology OR Computer applications in Environment	02	--	**02**	02	--
Research Project	SENVRP2501	Research Project	04	--	**04**	04	
DSC Practical	SENVCP2501	Practical Based on SENVCT2501	--	01	**01**	--	02
	SENVCP2502	Practical Based on SENVCT2502	--	01	**01**	--	02
	SENVCP2503	Practical Based on SENVCT503	--	01	**01**	--	02
DSE Practical	SENVEP2501 OR SENVEP2502	Elective Lab Based on SENVET2501 OR Elective Lab Based on SENVET2502	--	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)]

Subject	Course Code	Course Name	Theory				Practical		Total Marks
			Continuous Assessment (CA)			ESA			
			Test I	Test II	Avg of (T1+T2)/2	Total	CA	ESA	
Major	SENVCT2501	Solid waste management	20	20	20	80	--	--	100
	SENVCT2502	Water and Wastewater Treatment Technology	20	20	20	80	--	--	100
	SENVCT503	Remote sensing and Geographical Information System	20	20	20	80	--	--	100
Elective (DSE)	SENVET2501 OR SENVET2502	Environmental Biotechnology OR Computer applications in Environment	10	10	10	40	--	--	50
Research Project	SENVRP2501	Research Project					--	--	150
DSC Practical	SENVCP2501	Practical Based on SENVCT2501	--	--	--	--	05	20	25
	SENVCP2502	Practical Based on SENVCT2502	--	--	--	--	05	20	25
	SENVCP2503	Practical Based on SENVCT503	--	--	--	--	05	20	25
DSE Practical	SENVEP2501 OR SENVEP2502	Elective Lab Based on SENVET2501 OR Elective Lab Based on SENVET2502	--	--	--	--	05	20	25

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

Teaching Scheme

Subject	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SENVCT2551	Industrial Pollution Control and Safety	04	--	04	04	--
	SENVCT2552	Environmental Management and EIA	04	--	04	04	--
Elective (DSE)	SENVET2551 OR SENVET2552	Disaster Management OR Green technology	03	--	03	03	--
RM	SENVPE2551	Publication Ethics	02	--	02	02	
Research Project	SENVRP2551	Research Project	06	--	06		150
DSC Practical	SENVCP2551	Practical Based on SENVCT2551	--	01	01	--	02
	SENVCP2552	Practical Based on SENVCT2552	--	01	01	--	02
DSE Practical	SENVEP2551 OR SENVEP2552	Elective Lab Based on SENVET2551 OR Elective Lab Based on SENVET2552	--	01	01	--	02
Total Credits			19	03	22	13	06

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

Examination Scheme

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

Subject	Course Code	Course Name	Theory				Practical		Total Marks
			Continuous Assessment (CA)			ESA			
			Test I	Test II	Avg of (T1+T2)/2	Total	CA	ESA	
Major	SENVCT2551	Industrial Pollution Control and Safety	20	20	20	80	--	--	100
	SENVCT2552	Environmental Management and EIA	20	20	20	80	--	--	100
Elective (DSE)	SENVET2551 OR SENVET2552	Disaster Management OR Green technology	15	15	15	60	--	--	75
RM	SENVPE2551	Publication Ethics	10	10	10	40	--	--	50
Research Project	SENVRP2551	Research Project							150
DSC Practical	SENVCP2551	Practical Based on SENVCT2551	--	--	--	--	05	20	25
	SENVCP2552	Practical Based on SENVCT2552	--	--	--	--	05	20	25
DSE Practical	SENVEP2551 OR SENVEP2552	Elective Lab Based on SENVET2551 OR Elective Lab Based on SENVET2552	--	--	--	--	05	20	25

M. Sc. Second Year Semester III

Course Details

SENVCC2501: Solid waste management (4 credits)

Course pre-requisite:

- This course may opt by any students from any discipline to understand the environmental pollutants and their pathway.
- Students will learn how to mitigate the solid waste problems by 4 R principle and product development from waste to wealth.

Course objectives:

- The aim of this paper is to enhance the knowledge of soil and solid waste pollution and their sources and impacts.
- To promote awareness among individual and societal level regarding do and don'ts of hazardous waste.
- To undertake the role of individual/volunteer in mitigation & environmental pollution problems.
- To understand the remedial measures/techniques for solid waste disposal.

Course outcomes:

- At the completion of the course the students will be able to Analyze and interpret the solid waste pollution problems and associated risk to environment.
- Students are able to design environmental engineering and eco-friendly systems to mitigate solid waste problems.
- It helps to forecast and predict fate of pollutants in the environment.
- It may help to identify best waste management practices, modern tools and techniques
- 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:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction of solid waste**	**15**
	1.1	Introduction of solid waste, Sources and characteristics; Composition,	
	1.2	Types of solid wastes: Residential wastes, Commercial wastes, Industrial wastes.	
	1.3	Hazardous waste Types, characteristics and health impacts.	
	1.4	Biomedical waste, e-waste: classification,	
2.0		**Methods of handling and disposal of solid waste**	**15**
	2.1	Methods of handling and disposal. Solid waste collection and transportation,	
	2.2	container systems - hauled and stationary, layout of collection routes, transfer stations.	
	2.3	Plastic waste: sources, consequences and management.	
	2.4	Fly ash: sources, composition and utilization.	
3.0		**Solid waste management and Control techniques**	**15**
	3.1	Solid waste processing and recovery– Recycling, recovery of materials for recycling and direct manufacture of solid waste products.	
	3.2	Electrical energy generation from solid waste (Fuel pellets, Refuse derived fuels)	
	3.3	composting and Vermicomposting, biomethanation of solid waste	
	3.4	Disposal of solid wastes – sanitary land filling and its management, incineration of solid waste. Hog feeding, open dumping, Pyrolysis, incineration, Controlled tipping, Pulverization, Hammer mills, rotating drum machines. 4R 'principles of solid waste,	
4.0		**Solid waste management and legislation**	**15**
	4.1	Solid waste pollution scenario in India, The Solid Waste Management Rules, 2016, The Construction and Demolition Waste Management Rules, 2016;	
	4.2	Hazardous waste management: Treatment Methods – neutralization, oxidation reduction etc, Hazardous waste management Act 1989,	
	4.3	The Plastic Waste Management Rules, 2016, The e-waste (Management) Rules 2016,	
	4.4	The Bio-Medical Waste Management Rules, 2016. Case studies	
		Total	**60**

Text Books:

- Soil and Noise Pollution: B. K. Sharma, H. Kaur, Goel Publishing House, Meerut, 1994.
- Solid waste pollution : Dr. Aradhana Salpekar, Jnanada Prakashan, New Delhi, 2008.
- Principals of soil science : M. M. Rai
- Soil pollution & Soil organisms : P. C. Mishra
- Environmental Chemistry: B. K. Sharma
- Environmental Science : S. C. santra, New Central Book Agency, Kolkata, 2005

Reference Books:

- Environmental Pollution Control Engineering, C. S. Rao, New age International, Mumbai, 2003..
- Fundamentals of Soil Science : Henry D. Foth, John Wiley & Sons, New York, 1984
- Environmental Engineering : Davis & Cornwell, McGraw – Hill Publications, New York, 1998
- Environmental Science Principles and Practices : R. C. Das, D. K. Behra, Printice Hall, New Delhi, 2008

SENVCP2501: Practical Based on (SENVCT2501) Solid waste management (1 credit)

1) To study the vermicomposting methods.
2) To study the sanitary landfilling design methods.
3) Design and operational Specifications of Biomethanation Process
4) Design and operational Specifications for MSW Incineration.
5) To study the recycling methods/programmes for solid wastes
6) To study the typical Design of Leachate Treatment Plant
7) To study the biomedical waste collection, storage and disposal techniques.
8) To study the hazardous waste handling and management rules.
9) Description of important industrial solid waste recycling.
10) To study the sewage treatment plant (STP).
11) Field work

SENVCT2502: Water and waste water treatment technology (4 credits)

Course pre-requisite:

- This course useful in any discipline of Science would understand the need of water and its importance
- This course will help to regenerate the opportunities for students and highly beneficial for societies.

Course objectives:

- Achieve an interim level of water quality that provides for the protection for fish, wetlands, and wildlife with recreation.
- To understand and mitigate the possible techniques to reduce water pollution.
- To predict water pollution and reuse the waste water after treatment.
- It enhances the new materials and process technologies for water and wastewater treatment, including membranes, advanced oxidation, other processes.

Course outcomes:

- Treatment technology includes physical, biological and chemical methods which improves the quality for reuse.
- This paper as benefited as in the water scared area while applying the technology will receive the outcome in the form of clean water.
- It is one the best way for students who utilize the ideas and apply on it and get opportunities for their carrier.
- It helps in removing in residual substances by treatment processes and again discharging them on surface water as well as for ground water recharge.
- It helps in reduce organic and suspended solids to limit pollution to the environment.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0		**Water Characteristics**	**15**
	1.1	Quality of Water, Requirements, Sources of water and their quality	
	1.2	Analysis of Water, Purpose of Water analysis	
	1.3	Sampling, Physical Examination of Water, Chemical Examination of Water, Biological Examination of Water	
	1.4	Water standards, Water borne diseases	
2.0		**Water Treatment**	**15**
	2.1	Water Treatment Processes, Layout, Component	
	2.2	Screening, Aeration and their types	

	2.3	Plain Sedimentation, Sedimentation with Coagulation	
	2.4	Filtration, Disinfection, Miscellaneous methods	
3.0		**Wastewater Characteristics**	**15**
	3.1	Sources of sewage or wastewater flows	
	3.2	Sewage or wastewater Quantity, Dry weather flow, storm water flow	
	3.3	Wastewater Characteristics, Objectives of Wastewater Treatment, Sampling, Wastewater analysis	
	3.4	Physical Characteristics, Chemical Characteristics, Biological Characteristics,	
4.0		**Wastewater Treatment**	**15**
	4.1	Wastewater Treatment- Preliminary and primary treatment, Screens, Grit chambers, Skimming tanks, Sedimentation	
	4.2	Secondary Wastewater Treatment, activated sludge process, trickling filters	
	4.3	Low-cost treatment methods, Oxidation ponds, Aerated lagoons, Oxidation ditches, Septic tanks	
	4.4	Sources and effects of sludge on environment. Methods of sludge disposal, Anaerobic treatment of sludge, Industrial Wastewater Treatment	
		Total	**60**

Text Books:

- S C Rangwala, Water Supply & Sanitary Engineering, Chatwal Publishing house, Anand
- M. N. Rao, A. K. Datta, Waste water treatment, Oxford and IBH publishing company, New Delhi
- Metcalf and Eddy, Waste water Engineering, Tata Mc-Grew Hill Publishing Company, New Delhi
- Mackenzie L. Davis & David A. Cornwell, Introduction to Environmental Engineering, Mc-Grew Hill Publishing Company, New Delhi.

Reference Books:

- Gabriel Bitton, 2nd Edition, Wastewater Microbiology, Wiley-Liss; 2nd Edn (1999)
- Martin Alexander, Biodegradation and Bioremediation. Academic Press; 2nd Edn.
- Waste water treatment for pollution control: Soli J. Arceivala (Tata Mc-Grew Hill Publishing Company, New Delhi
- Aquatic Plants for the Waste Water Treatment, Alkarani Upadhaya (Daya Publishing House, New Delhi).
- Water Pollution and disposal of Waste water on Land : U. N. Mahida (Tata Mc-Grew Hill Publishing Company, New Delhi.

SENVCP2502: Practical Based on (SENVCT2502) Water and waste water treatment technology (1 credit)

1. Determination of pH of given water sample.
2. Determination of Total Hardness of given water sample
3. Determination of Permanent Hardness of given water sample
4. Determination of Carbonates and Bicarbonates of given water sample
5. Estimation of calcium by Murexide method of given water sample
6. Estimation of magnesium by titrometric method of given water sample
7. Determination of Alkalinity by Titrometric method of given water sample
8. Estimation of turbidity of given water sample by turbidity meter.
9. Determination of EC of given water sample.
10. Determination of TDS of given water sample.
11. Determination of fluoride concentration of given water sample.
12. Determination of BOD from Industrial effluents of given water sample.
13. Determination of COD from Industrial effluents of given water sample.
14. Determination of Sludge volume index.
15. Study of STP.
16. Study of ETP.

SENVCT2501: Remote Sensing and GIS (4 credits)

Course pre-requisite:

- Basic understanding about Remote sensing and GIS techniques.

Course objectives:

This course aims to:

1. Introduce the students to the fundamental concepts of Remote Sensing, GIS and GPS technologies.
2. They will learn to identify different features with the help of Photo-interpretation Elements
3. It will make them familiar with the most essential GIS techniques with hands on practical experience.
4. Students will learn about creation and organization of spatial and non spatial data.
5. Learn different GIS based techniques to identify and solve the actual natural, environmental and community problems.
6. Learn application of GIS and GPS.
7. Use Remote Sensing and GIS techniques to identify and solve the actual natural, environmental and community problems.

Course outcomes:

After successful completion of this course, a student would be able to

1. Explain the Fundamental principles of Remote Sensing and GIS
2. Differentiate between different data types in GIS.
3. Georeference the spatial data and work on spatial and nonspatial database
4. Describe various GIS tools and techniques
5. Explain the fundamental principles behind GPS technology
6. Visualize GIS outputs in different dimensions
7. Create digital GIS maps
8. Apply spatial data analysis for various applications to deal with natural and environmental problems.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction to Remote Sensing**	**15**
	1.1	Definition, Characteristics of EMR, Platforms, Fundamentals of Aerial Photography, History of Aerial Photographs, Types of Aerial Photographs	
	1.2	EMR and its interaction with matter, Reflection, Absorption, Transmission, Scattering. Concept of Signatures- Photo Interpretation Elements	
	1.3	Indian Remote Sensing Programme, Types of Satellites- Sun-synchronous and Geostationary Satellites, Launch Vehicles- PSLV, GSLV, Payloads, Active and Passive Remote Sensing, Classification of Remote Sensors, Resolution- Spatial, Spectral, Radiometric, Temporal	
	1.4	Photogrammetry - Basic Geometric Characteristics- Scale, Overlap, Tilt, Distortion and Displacement of Aerial Photographs, Advantages and Disadvantages of Aerial Photographs	
2.0		Introduction to GIS	**15**
	2.1	Introduction to GIS, Definition, History of GIS, Scope and Importance of GIS, Contributing disciplines, Development of GIS, Components of GIS, Hardware and Software components, GIS diversity	
	2.2	Data models in GIS - Raster data model, Vector data model, basic entities of GIS: line, point and polygon, Geodatabase,	
	2.3	Map Projection, Types and Need of projection system, Data: Primary and Secondary, Spatial and Attribute data, data editing in GIS,	
	2.4	Acquisition of spatial data: Scanning, Georeferencing, concept of layer, digitizing, error detection and correction, Data Base Management System: Concept, types of DBMS, Hierarchical, Network and relational data models, advantages and disadvantages	
3.0		**Global Positioning Systems**	**15**
	3.1	Global Positioning Systems, History and developments in GPS, Trilateration process, types of GPS, GPS Surveys, Applications of GPS technology	
	3.2	Mapping and layout, General processes involved in image processing, mosaic, subset,	
	3.3	Point interpolation techniques: Krigging, IDW,	
	3.4	Introduction and Methods of Interpolation, Data analysis, network analysis, DEM and DTM, Thematic maps.	

4.0		**Applications of Remote Sensing and GIS**	**15**
	4.1	Introduction, Digital Image Processing- Image Classification, Supervised and Unsupervised Classification,	
	4.2	Applications in Agriculture and Forest management	
	4.3	Land use Land Cover mapping, Natural hazards identification and management,	
	4.4	Water resources, Snow and glaciers studies, Coastal zone management, Marine fisheries etc.	
		Total	**60**

Reference Books

- Ahmed, E. L. Rabbany (2002): Introduction to Global Positioning Systems, Artech House, Boston
- Anji Reddy, M. (2008): Textbook of Remote Sensing and Geographic Information System, B.S. Publication, Hyderabad
- Burrough, P. A. and McDonnell, R. A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
- Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
- Demers, M. N. (2000): Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi
- Heywood, I., Cornelisus, S., Carver, S. (2011): An Introduction to Geographical Information Systems, Pearson Education, New Delhi
- Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
- Korte, G. B. (2001): The GIS Book, Onward Press, Bangalore
- Lo, C. P., Yeung, A. W. (2002): Concepts Techniques of Geographical Information Systems, Prentice-Hall of India, New Delhi
- Longley, P. A., Goodchild, M. F., Maguire, D. J., Rhind, D. W. (2002): Geographical Information Systems and Science, John Wiley & Sons, Chichester
- Image Interpretation in Geology by Drury
- Introduction to Remote Sensing by J. B. Campbell
- Photogrammetry by Miller and Miller
- Principles & Applications of Photogeology by S. N. Pande
- Remote Sensing & Image Interpretation by T. M. Lillesand and W. K Ralph
- Remote Sensing in Geology by Siegal
- Remote Sensing: Principles and Interpretation by F. F. Sabins

SENVCP2503: Practical Based on (SENVCT2503) RS and GIS (1 credit)

1) Introduction to GIS Softwares
2) Data Input in GIS Softwares
3) Geo Referencing
4) Mosaic
5) Subset
6) Interpretation of Aerial Photographs using mirror stereoscope
7) Interpretation of Aerial Photographs using pocket stereoscope
8) Calculations of Scale, Relief Displacement
9) Projections
10) Digitization of Map/ Toposheet
11) Creation of Thematic Maps / Base Map Preparation
12) Adding Attribute Data – Querying on Attribute Data
13) Vector Analysis
14) Raster Analysis
15) Map Composition
16) Developing Digital Elevation Model
17) Simple Applications of GIS
18) Applications of Google Earth

SENVET2501: Environmental Biotechnology (2 credits)

Course pre-requisite:

- Knowledge about different kinds of pollution and their sources.
- Knowledge about different types of microbes, composition and decomposition of wastes.

Course objectives:

- This course aims to enable the students to gain in depth knowledge about the basics of biotechnology.
- This course aims to enable the students to gain knowledge about the applications of biotechnology in environmental science.

Course outcomes:

- On successful completion of the module, students should be capable of identifying the environmental problem and use the appropriate biosensors to identify it.
- On successful completion of the module, students should be capable identifying suitable biotechnological solution to the environmental problem using a suitable biotool.
- On successful completion of the module, students should be capable Using bioremediation techniques to abate environmental problems.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction to Environmental Biotechnology**	**08**
	1.1	Introduction and scope of Environmental biotechnology	
	1.2	Biological treatment, Factors impacting Bio-treatment	
	1.3	importance of microorganism and their growth	
	1.4	Biotechnological approach of environmental pollution abatement	
2.0		**Bio-tools and Applications**	**08**
	2.1	Biotechnological approach of energy management, Biomass	
	2.2	Biogas generation and its significance in waste recycling, Factors affecting biogas yield, Advantages and disadvantages. composting, Merits and demerits	
	2.3	Biofuels: Bio-ethanol, Bio-diesel, Bio-hydrogen	
	2.4	Bio-fertilizer: bacteria and fungi. Natural composting,	

		Vermi-composting and Earthworm technology, Use of surface worms, Typical Vermiculture plant, Maintenance and limitations of Verm technology	
3.0		**Biosensors and Bioreactors**	**08**
	3.1	Biosensors and environmental pollutants	
	3.2	Biochemical Oxygen Demand sensors, Ammonia sensors, Nitrate sensors, Sulphate ion sensors, its advantages and disadvantages.	
	3.3	Bioreactors and its scope, Biological filters, Rotating biological contractors (RBC) merits and demerits, Fluidized bed reactors, Inverse fluidized bed bio-film reactor (IFBBR),	
	3.4	Expanded bed reactor (EBR), Contact digester, Packed bed reactors (PCR), Up-flow anaerobic sludge blanket reactors (UASB), Periodic biological Sequencing batch reactor (SBR), Membrane bioreactor	
4.0		**Bioremediation and Reclaimation**	**06**
	4.1	Bioremediation, Types of bioremediations, Bio-remedial applications	
	4.2	Toxic site reclamation, Removal of spilled oil and grease deposits.	
	4.3	Reduction of herbicides, pesticides and fertilizers	
	4.4	Biodegradation of xenobiotics, Toxic organics, Phenols	
		Total	**30**

Text Books:

- S. N. Jogdand, Environmental Biotechnology, Himalaya Publishing House, Mumbai, 2006
- G R Chatwal & Harish Sharma,A textbook of Environmental Studies, Himalaya Publication House, New Delhi, 2004
- R. C. Dubey, A Textbook of Biotechnology, S. Chand & Company, New Delhi, 2002
- A. K Chatterji, Introduction to Environmental Biotechnology, PHI learning Pvt.Lim., New Dehli, 2009

Reference Books:

- S S Dara, A textbook of Environmental Chemistry & Pollution Control, S. Chand & Company, New Delhi, 2002
- B.P. Singh, H. N. Verma & K. M. Srivastava,Environment & Biotechnology, Today & Tomorrows & Publishers, New Delhi, 1988
- Indu shekhar Thakur, Industrial Biotechnology (Problems & remedies), I. K. International Pvt. Ltd., New Delhi, 2006

SENVEP2501: Practicals based on (SENVET2501) Environmental Biotechnology (1 credit)

01. Estimation of chlorophyll from the given plant material.
02. Estimation of nitrite-nitrogen from the sample by Spectrophotometer.
03. Determination of phosphate from the sample by Spectrophotometer.
04. Determination of ammonia from the sample by Spectrophotometer.
05. Isolation of Rhizobium from root nodule.
06. Isolation of Azotobactor from soil.
07. Study of enzyme activity (oxidase test).
08. Estimation of alcohol by bakers Yeast.
09. Preparation of Potato Dextrose Agar.
10. Preparation of Nutrient Agar.

SENVET2502: Computer applications in Environment (2 credits)

Pre-requisites:

- Basic understanding and interest about Computer system, its applications and working.

Course Objectives:

- To discuss the fundamentals of Computer Organization and Architecture
- To generate qualified manpower in the area of information and technology who can work anywhere seamlessly
- Introduction to various aspects of computer applications and to equip students with emerging technologies in the computer field.

Course Outcomes:

- After successful completion of this course, a student should know
- The fundamental knowledge about computers and computer applications.
- Students will get the knowledge of computer organization and architecture and will know the actual working and organization of digital computer system.
- They will be familiar with basics of computer applications and other important concepts like networking concepts.
- They can easily use computers for day-to-day activities.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		Introduction to computer	**08**
	1.1	Introduction to computer: Definition, Scope and importance of Computers, Input and output devices,	
	1.2	Computer memory and storage devices,	
	1.3	Types of computers based on size, memory and signal	
	1.4	Computer generations and their characteristics	
2.0		Computer organizations	**08**
	2.1	Computer organizations, Basic block diagram of computer	
	2.2	Components of computer, Hardware and Software, input/output devices	
	2.3	Number systems: Binary, decimal and hexadecimal number system in computers,	
	2.4	Software, Types of software, MS office	

3.0		**Data and Data representation**	**08**
	3.1	Graphical data presentation,	
	3.2	Diagrammatic representation of Data: Simple bar diagram, Multiple bar diagram, Pie diagram;	
	3.3	Data: Classification of Data; Collection of Data: Collection of primary data, Collection of Secondary data	
	3.4	DBMS	
4.0		communication and networking	**06**
	4.1	Concept of operating system	
	4.2	Computer graphics, Basic concepts of data communication and networking	
	4.3	Website, Internet, Applications of Internet, E-mail	
	4.4	Applications of computer, Applications of Google Earth Search Engine	
		Total	**30**

Reference Books

01. Evolution Biostatistics & Computer Applications: A. Gopi, A. Meena, N. Arumugam, Saras Publications, Kanyakumari, 2003
02. Fundamentals of Computer: V. Rajaraman, Prentice Hall of India, New Delhi, 2008
03. Computer Fundamentals: Pradeep K. sinha, Preeti Sinha, BPB Publications, New Delhi
04. Computer: Malhar V. Lathkar, Sadhusudha Prakashan, Nanded, 1995
05. Computer Fundamentals: A. Goel, Pearson Education, 2010.
06. Fundamentals of Computers: P. K.Sinha, P. Sinha, BPB Publishers, 2007
07. Digital Computer Fundamentals, Tata McGraw Hill, 6th Edition, Thomas C. Bartee
08. Sinha P. K. ―Computer Fundamentals, BPB.
09. Jain, Chaturvedi and Sahu, ―Overview of Operating Systems‖, Pragya Pub. Mathura.
10. Hansen G. W. & Hansen J. V. ―Database Management & Design‖.
11. Silberschqtz, Korth & sudarshan Database System Concepts ― 5th Edition ―PHI‖
12. Tanenbaum A. S., ―Computer Networks‖, PHI.
13. Database Systems and Concepts, Henry F. Korth
14. Database Management System by Bipin Desai
15. A. Goel, Computer Fundamentals, Pearson Education, 2010.
16. P. Aksoy, L. DeNardis, Introduction to Information Technology, Cengage Learning, 2006
17. P. K.Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers, 2007
18. P. Rob, C. Coronel, Database System Concepts by, Cengage Learning India, 2008
19. R. Elmsasri,S. Navathe, Fundamentals of Database Systems, Pearson Education, 5th edi. 2007
20. Computer Networks, Andrew S.Tanenbaum, Prentice Hall of India.

SENVEP2502: Practical's based on (SENVET2502) Computer applications in Environment (1 credit)

1) To study History of Computer.
2) To study various Input/output devices.
3) Getting familiar with basic computer hardware: peripheral devices
4) To study Microsoft word.
5) To study Microsoft power point.
6) To study Microsoft Excel.
7) To study Mail merge
8) To study computer generations
9) To study Binary, Decimal and hexadecimal number system and conversions
10) To study operating systems
11) Cration of Google Forms
12) Creation / Designing of Website Portal

M. Sc. Second Year (Semester IV)

SENVCT2551: Industrial Pollution Control and Safety (4 credits)

Pre–requisites:

- This course can prefer by any students of Science discipline to understand the environmental pollutants and their pathways. Students will learn how to mitigate the industrial pollution and its impact on environment.

Course Objectives:

- To bring about all round improvement in the quality of the Environment in and around by effective implementation in pollution control measures.
- To Identifications of sites and development of procedures and methods for the max reuse, recycle and then disposal of hazardous wastes.
- Using different Environmental cleaning devices can create a healthy and natural Environment.
- 96
- Minimal expenditure with cost effective benefits and the course one can easily understand and apply everywhere.
- To promote new developed / developing technologies in the area of air pollution control.
- To minimize the hazardous emissions disperse into the environment.
- Identification of agencies / groups / individual involved in field of industrial air pollution control.
- To work out a suggestive action plan for implementation of suitable / feasible technologies / measures for air pollution abatement.

Course Outcomes:

After completion of the course the students will be able to

- By completion of this course, student can control pollution, methods with cost effective.
- The course indeed Industrial impact on Soil, Air, Water as well as Environment.
- To evaluate solutions to reduce the different kinds of pollution sources.
- It may be helpful to distinguish between various industrial pollutants.
- Organic and inorganic wastes are released at large amount of the most eco-toxic materials.
- The system should be able to degrade, pollutant by microbes, fungi, as it will destroy toxicants.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		Introduction to Industrial pollution	**15**
	1.1	Introduction: Industrial pollution, Different types of wastes generated in an industry	
	1.2	Air pollutants and Solid wastes from industry, Their effects on living and non-living things	
	1.3	Importance of industrial pollution abatement, Air Pollution Control: Sources and classification of air pollutants	
	1.4	Environmental regulatory legislations and standards	
2.0		**Gaseous emissions and its Control**	**15**
	2.1	Nature and characteristics of gaseous pollutants and particulate matter, pollutants from automobiles.	
	2.2	Control of gaseous emissions by absorption, adsorption. Recycle and Reuse of waste, Energy recovery and waste utilization, Design of cyclones, ESP, fabric filters and absorbers.	
	2.3	Water use minimization, fugitive emission/effluents and leakages and maintenance	
	2.4	Wet gas scrubbing, gaseous emission control by absorption and adsorption	
3.0		Water Pollution	**15**
	3.1	Water Pollution: Identification, Classification	
	3.2	physico-chemical and biochemical techniques,	
	3.3	General concept of primary treatment, Physical treatment, pre-treatment	
	3.4	solids removal by setting and sedimentation	
4.0		**Industries Activities**	**15**
	4.1	Dyes Drugs, Paints, Oil Refineries	
	4.2	filtration centrifugation, coagulation	
	4.3	Fertilizer, Glass, Rubber, Sugar Industries and Thermal power plants etc.	
	4.4	Industrial pollution control, safety equipment's, safety act, safety training and requirements	
		Total	**60**

Reference Books

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

SENVCP2551: Practical Based on (SENVCT2551) (IPCS) (1 credit)

1) Introduction to Industrial pollution
2) To identify and classify sources of \pollution
3) To study industrial sampling
4) To study Nature and characteristics of gaseous pollutants and particulate matter from automobile industries
5) To study Nature and characteristics of gaseous pollutants and particulate matter from industries
6) Determination of Suspended Particulate Matter and Respirable Suspended Particulate Matter using HVAS
7) Determination of SOx and NOx using HVAS
8) To study construction and working of cyclones filters
9) To study construction and working of ESP
10) To study construction and working of fabric filters and absorbers.
11) To understand Role and functions of SPCB in pollution monitoring
12) To understand Role and functions of CPCB in pollution monitoring
13) Case Studies
14) Field Visits

SENVCT2552: Environmental Management and EIA (4 credits)

Course pre-requisite:

- This course may opt by any students from any discipline 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:

oduleNo.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction of Environmental Management**	**15**
	1.1	Environmental management Plan (EMP). Management, Objectives and Components. Deforestation, Afforestation, Industrial forestry, Medicinal forestry and their significance.	
	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, Environmental Policies: Global Environmental Policies and National Strategies for Protection of Environmental quality International Policies. The Agenda 21 of Earth Summit, Major International Organizations and Agencies Involved in Environmental management.	
	1.4	Stockholm Conference on Human Environment 1972, Montreal Protocol, 1987, Ramsar Convention on Wetlands (1971), Earth Summit at Rio de Janeiro, 1992, Agenda-21, Global Environmental Facility (GEF), Convention on Biodiversity (1992), UNFCCC, Kyoto Protocol, 1997.	
2.0		**Environmental policy and planning**	**15**
	2.1	Clean Development Mechanism (CDM), Earth Summit at Johannesburg, 2002, RIO+20, Copenhagen Summit, 2009.	
	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**	**15**
	3.1	Overview of Environmental Laws in India: Constitutional provisions in India (Article 48A and 51A). Basic Concepts and Principles; History of Environmental Legislation;	
	3.2	Environmental Acts and Policies, Scope for improvement; National Environmental Policy Act, Environmental Tribunal; Green benches - working and need for betterment of Environmental system,	
	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).	
	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)**	**15**
	4.1	Environmental Impact Assessment (EIA), Aims and objectives of EIA, EIA Methods: Environmental impact statement (EIS), Procedure for reviewing EIA of developmental projects.	

	4.2	Life-cycle analysis, cost-benefit analysis, Guidelines for Environmental Audit. Collection of base line data, Selection of data source, etc	
	4.3	EIA Check lists, Matrix & Network methods for EIA. Prediction of short- & long-term impacts on environment (physical, biological & socio culture).	
	4.4	Public Participation, Methodology and approach for public participation, Regulatory requirements, Advantages and disadvantages of Public participation, EIA Notification 1994, 2006 and amendments. Accreditation of EIA consultants by Quality Control of India – requirements and guidelines, Case studies related EIA.	
		Total	**60**

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.

SENVCP2552: Practical Based on (SENVCT2552) 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

SENVET2551: Disaster Management (3 credits)

Course pre-requisite:

- The course may be learned by any students of any discipline as Disaster Management (DM) is multi-disciplinary and draws its knowledge base from a range of disciplines. The overall aim of this is to provide broad understanding about the basic concepts of Disaster and its management.
- This course may offer specializations in areas like threat response, disaster management, disaster preparedness or public administration.
- It also requires prerequisites in leadership, organizational behavior, emergency services, public administration, strategic planning, and occupational safety and health.

Course objectives:

- The aim of Approaches to Disaster Risk Reduction is to enhance the knowledge by providing existing models in risk reduction strategies to prevent major causalities during disaster.
- To promote Prevention and Preparedness plan for disaster mitigation
- To undertake the role of individual/volunteer in mitigation & Risk Reduction steps
- To prioritize Rescue and Relief operation during disaster.
- To understand the causes, effects and remedial measures for disaster.

Course outcomes:

- It helps to learn the concept of Disaster Management and its application during on site and off-site emergency.
- The project/field work is meant for students to understand vulnerabilities and to work on reducing disaster risk, project/case studies are conceived creatively based on the geographic location and hazard profile of given region etc.
- It may help to individual to create the ability for mitigate the disaster risk.
- It is important to learn the Preparedness plans for disaster response.
- It creates the ability monitoring and evaluation plan for disaster response and its functioning at national/state/district level.
- It may help to learners to create hazard/risk profile maps of any geographical area.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction of Disaster**	**15**
	1.1	Introduction of Disaster, Disaster potential in India, Types/Classification of Disasters.	
	1.2	Natural and Manmade disasters, Flood, Landslide, Earthquake, Volcanism, Cyclones, Drought, Fire, Tsunami, mining, Wind storms,	
	1.3	Nuclear/Biological/Chemical disasters, Environmental pollution, Global warming, Road/Rail accidents,	
	1.4	Endemic/Pandemic disasters etc.,	
2.0		**Impacts of Disaster**	**10**
	2.1	Disaster Impacts: Disaster loss, Social and economic impacts, Environmental Impacts,	
	2.2	Reconstruction and Rehabilitation problems, Damage assessment, Hazard identification,	
	2.3	Disaster Risk and Vulnerability, Disaster risk reduction, Risk analysis techniques,	
	2.4	Primary and secondary impacts of disasters etc.	
3.0		**Disaster management**	**10**
	3.1	Disaster prediction, Disaster mitigation strategies, Disaster management cycle basic components of	
	3.2	Disaster prevention, Disaster preparedness, disaster preparedness plan for people and infrastructure, community-based disaster preparedness plan,	
	3.3	Early warning system model in disaster preparedness,	
	3.4	Disaster relief (Water, Food, Sanitation, Shelter, Health, Waste management etc.,).	
4.0		**Disaster Legislation**	**10**
	4.1	Disaster management Act- 2005, National/State/District level disaster management	
	4.2	Disaster mitigation, Role of International agencies, NGO‘s, Community based Organizations (CBO‘s). Disaster vulnerabilities.	
	4.3	Role of individual, voluntary organization, Disaster monitoring and evaluation, Disaster relief fund, Disaster related case studies	
	4.4	disaster risk, project/case studies are conceived creatively based on the geographic location and hazard profile of given region etc.	
		Total	**45**

Text Books:

1. Natural Disaster Reduction: Girish K.M. and G.C.Mathur, Reliance Publishing House, New Delhi. (1993)

2. Disaster Management: Shailendra K.Singh , Subhash. C, Kundu and Shobhue Singh , Mittal Publications, New Delhi. (1998)

3. Disaster Preparedness in India:Narendra Kumar Jain, Adhyatma Sadhana Kendra, New Delhi.(1996)

4. Disaster Management: Dr. S. R. Singh, A. P. H. Publishing Carporation, New Delhi, (2008)

5. Environmental Science: S. C. Santra, New Central Book Agency, Kolkata, 2005.

Reference Books

1. Bryant Edwards (2005), Natural hazard, Cambridge University press, UK.

2. Roy, P S. (2000): Space technology for disaster management: A remote sensing and GIS perspective, Indian institute of Remote sensing (NRSA), Dehradhun.

3. Sharma R. K. and Sharma G. (2005) (ed): Natural Disaster, APH Publishing corporation, New Delhi.

SENVEP2551: Practical based on (SENVET2551) Disaster Management (1 credit)

1) To prepare the map showing major disasters in India (1980-2023).
2) To prepare the disaster vulnerability map of India.
3) To prepare the seismic zonation map of India is liable to seismic hazard damage.
4) To calculate the distance to epicentre.
5) To prepare the table showing MM scale vs. Richter scale relationship.
6) To prepare the map of showing landslide prone area in India.
7) To prepare the map of showing cyclone prone area in India.
8) To prepare the map of showing flood prone area in India.
9) To prepare the map of showing Tsunami prone area in India.
10) Write do and don'ts before, during and after disaster for natural disasters like earthquake, landslide, cyclone, flood, tsunami etc
11) To study the early warning system for disaster management.
12) To prepare the disaster related case study.
13) Visit to disaster prone area and make report

SENVET2552: Green technology (3 credits)

Course pre-requisite:

- Knowledge about different kinds of pollution and their sources.
- Knowledge about different types of environmental problems.

Course objectives:

- To provide basic knowledge on green technology.
- To understand the principles of green chemistry and eco friendly methodologies.
- To create awarenes on Clener development mechanisms.
- To develop concepts on various energy efficient systems and green buildings.

Course outcomes:

By the end of the course, student will be able to:

- Realise the importance of green technologies in sustainable growth of Industry and society.
- Adopt alternative methods and solvents for green synthesis.
- Develop cleaner production and treatment mechanims for pollution prevention.
- Design and implementation of suitable energy efficient processes.
- Plan and use of selective materials for green buildings.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction to green chemistry and technology**	**8**
	1.1	Principles of green chemistry	
	1.2	Green technology-definition, importance,	
	1.3	Role of industry, government and institutions; industrial ecology	
	1.4	factors affecting green technology.	
2.0		**Green synthesis and Solvents**	**9**
	2.1	Green methods of synthesis- microwave assisted synthesis,	
	2.2	Solvent free techniques- Reaction on solid supports.	
	2.3	Alternative solvents Ionic liquids- general synthesis	
	2.4	Super critical fluids- extraction, process and applications.	
3.0		**Clean development technologies**	**13**

	3.1	Clean development mechanisms, role of industry;	
	3.2	Reuse, reduce and recycle, raw material substitution; wealth from waste;	
	3.3	Carbon credits, carbon trading, carbon sequestration, eco labelling.	
	3.4	Fenton chemistry, photocatalysis and hybrid processes	
4.0		**Energy efficient systems and Green Buildings**	**15**
	4.1	Energy efficient motors, energy efficient lighting, control and selection of luminaries; bio-fuels, fuel cells- working, selection of fuels	
	4.2	Green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of sustainable green production systems.	
	4.3	Green buildings, Definition- Features and benefits, Fundamental planning decisions for energy efficient building- site selection, buildings forms and orientations, building fabrics and insulation, ventilation, passive solar features.	
	4.4	Eco-friendly and cost-effective materials, Energy management, roof top solar photovoltaic system and solar tracking system, alternating roofing systems.	
		Total	**45**

Text Books:

1. Rashmi Sanghi and M.M. Srivastava, Green Chemistry-Environment Friendly Alternatives, Narosa Publishing House, New Delhi 2009.
2. Paul L. Bishop, Pollution prevention –Fundamentals and Practices, McGraw-Hill- international, 2000.

Reference Books:

- N. Vinutha bai, R. Ravindra, Energy efficient and green technology concepts, International Journal of Research in Engineering and Technology p 253-258, Volume: 03 Special Issue: 06
- Khan B.H, Non-conventional energy resources, Tata McGraw-Hill, New Delhi 2006.

SENVEP2552: Practicals based on (SENVET2552) Green Technology (1 credit)

1. Green chemistry and its applications
2. Cleaner development mechanisms and related techniques
3. carbon markets
4. Oxidation technology for waste water treatment
5. Energy efficient devices
6. selection of environment friendly fuels
7. selection of recyclable and environment friendly materials in green manufacturing
8. design and implementation of sustainable green production systems.
9. Fundamental planning decisions for energy efficient building
10. Eco-friendly and cost-effective materials
11. Energy management in Green building