U.G (T.D.C) PROGRAMME

under

NEP SCHEME

Department of Environmental Sciences

Faculty of Earth Science

M.L. SUKHADIA UNIVERSITY, UDAIPUR

Syllabus -2023-2024

Table 1: CBCS Course structure for B.A./B.Com./B.Sc. (Three Year Program) total credits 120						
	SEM-1	**SEM-II**	**SEM-III**	**SEM-IV**	**SEM-V**	**SEM-VI**
Core Courses	DCC-A1 (6 Cr) DCC-B1 (6 Cr) DCC-C1 (6 Cr)	DCC-A2 (6 Cr) DCC-B2 (6 Cr) DCC-C2 (6 Cr)	DCC-A3 (6 Cr) DCC-B3 (6 Cr) DCC-C3 (6 Cr)	DCC-A4 (6 Cr) DCC-B4 (6 Cr) DCC-C4 (6 Cr)	-	-
DSE / GEC	-	-	-	-	DSE-A1(6 Cr)DSE-B1(6 Cr) DSE-C1(6 Cr)	DSE-A1(6 Cr) DSE-B1(6 Cr) DSE-C1(6 Cr)
AECC	AECC-1 (2Cr)	-	-	-	AECC-2/MIL (2 Cr)	
SEC		SEC-1 (2Cr)	SEC-2 (2 Cr) Communicative English	SEC-3 (2 Cr)	-	SEC-4 (2Cr)
	18+0+2+0=20	**18+0+0+2=20**	**18+0+0+2=20**	**18+0+0+2=20**	**0+18+2+0=20**	**0+18+0+2=20**
72(DCC)+36(DSE/GEC)+4(AECC)+8(SEC)=120						

1. **Core courses (CC) : A, B, and C denote three different disciplines (subjects)**. A student will study 4papers in each discipline.
2. **Discipline Specific Elective (DSE):** A student will choose DSE courses from the three chosen disciplines (A, B, and C) for semesters V and VI. Any such paper can be Generic Elective Course (GEC) for the students of other disciplines.
3. **Ability Enhancement Compulsory Courses (AECC)** : Modern Indian Languages (MIL), English, Hindi Communication (Odia/Hindi/Telugu/Bangla/……)
4. **Skill Enhancement Courses (SEC):** Communicative English in the 3rd semester and three more subjects from a common pool. Each discipline provide at least one SEC
5. Courses with Practical component: Theory (4 credits) + Practical (2 credits) = 6 credits
6. Non-practical Courses: Theory (5 credits) + Tutorial (1 credit) = 6 credits (Numbers shown in brackets indicate Credits). In some of the disciplines it can be (2L+2P+2T) or (2L+4P)

1. In some of the disciplines it can be (2L+2P+2T) or (2L+4P).

EVS in B.Sc. Program: Semester wise course types, Course codes, Course title, Delivery type, Workload, Credits, Marks of Examination, and Remarks if any.

Level	Sem	Course Type	Course Code	Course Title	Delivery Type			Total Hours	Credit	Total Credit	Internal Assessment	EoS Exam	M.M.	Remarks
					L	T	P							
5	I	DCC	EVS5000T	Fundamentals of Ecology, Environment & Evolution	L	-	-	60	4	6	20	80	100	
			EVS5000 P	Environment Basics Lab	-	-	P	60	2		20	80	100	
	I	AECC			L	T	-	30	2	2	20	80	100	
	II	DCC	EVS5001T	Basics of Environmental Biology	L	-	-	60	4	6	20	80	100	
			EVS5001P	Field Ecology Lab I	-	-	P	60	2		20	80	100	
	II	AECC			L	T	-	30	2	2	20	80	100	
Exit with Certificate (with 04 additional exit credits in SEC)														
6	III	DCC	EVS6002T	Elements of Ecosystem Ecology	L	-	-	60	4	6	20	80	100	
			EVS6002P	Field Ecology Lab II	-	-	P	60	2		20	80	100	
		SEC			L	T	-	30	2	2	20	80	100	
	IV	DCC	EVS6003T	Natural Processes of Earth and Climate Change	L	-	-	60	4	6	20	80	100	
			EVS6003P	Water Analysis Lab	-	-	P	60	2		20	80	100	
		SEC	SES6340T	Ecotourism and wildlife conservation	L	T	-	30	2	2	20	80	100	.
Exit with Diploma														

7	V	**DSE	EVS7100T	Pollution Ecology	L	-	-	60	04	6	20	80	100	
			EVS7100P	Pollution Analysis Lab	-	-	P	60	2		20	80	100	
			EVS7101T	Toxicology	L	-	-	60	04	6	20	80	100	
			EVS7101P	Toxicology Lab	-	-	P	60	02		20	80	100	
		SEC	SES7341T	Fire hazard and management in industry	L	T	-	30	2	2	20	80	100	
	VI	**DSE	EVS7102T	Natural Resource Conservation	L	-	-	60	4	6	20	80	100	
			EVS7102P	Soil Analysis Lab	-	-	P	60	2		20	80	100	
			EVS7103T	Biodiversity Conservation	L	-	-	60	4	6	20	80	100	
			EVS7103P	Biodiversity Lab	-	-	P	60	2		20	80	100	
			EVS7104T	Waste Management	L	-	-	60	4	6	20	80	100	
			EVS7104P	Waste Analysis Lab	-	-	P	60	2		20	80	100	
		SEC	SES7342T	Industrial Health and safety	L	T	-	30	2	2	20	80	100	
Exit with B.Sc. Degree														

*** Any experiment which is set by the faculty relating to the course content may also be added.**

**** A minimum of 50% of the total admitted strength is required to run the options of papers as proposed in Semester V and VI (DSE-T & DSE-LAB) papers in UG Programme**

U.G (TDC) PROGRAMME under NEP SCHEME SYLLABUS (2023-2024)

B.Sc. (Three Years Degree Program)	
First Semester	
Subject-Environmental Sciences	
Code of the Course	**EVS5000T**
Title of the Course	**FUNDAMENTALS OF ECOLOGY, ENVIRONMENT & EVOLUTION**
Qualification Level of the Course	NHEQF Level 4.5
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in EVS
Delivery type of the Course	Lecture, 40+20=60. The 40 lectures for content delivery and 20 hours on diagnostic assessment, formative assessment and subject/class activity
Prerequisites	SCIENCE, biology stream of XII standard IN ANY BOARD
Co-requisites	None
Objectives of the course	to develop the concept and understanding of Ecology, its relationship with Environment and able to appreciate the holistic relationship with evolution
Learning outcomes	Have developed the knowledge of multidisciplinary outcomes and have an idea of professional learning for the subject
Syllabus	
UNIT I	Ecology : Definition, concept, scope and branches; Autecology, Synecology; Historical background of ecology : Ecology in Indian classics, in ancient Greek and Roman Literature, growth of ecology from 12^{th} to 20^{th} Century; Growth of plant as well as Animal Ecology in India; landscape, habitat, ecozones. (12 lectures)
UNIT II	Environment: Natural processes – Primeval atmosphere and origin of life; Structure and composition of present day atmosphere; atmosphere and earth radiation balance; Hydrosphere: atmospheric humidity and precipitation, hydrological cycle. Lithosphere – soil formation, soil texture, soil profile, soil classification, Biosphere - Definition, boundaries of biosphere. (12 lectures)
UNIT III	Paleontology and evolutionary History; evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multi cellular organisms; major groups of plants and animals; stages in primate evolution including Homosepians. (12 lectures)
UNIT IV	Evolution and Ecology – evidences and theories of organic evolution; Lamarck's concept of evolution; Darwin's Evolutionary Theory: variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations;

	Evolution of Man. (12 lectures)
UNIT V	Introduction to Taxonomy: Taxonomic Principles; Procedure of classification; Linean classification of plants and animals up to generic groups. (12 lectures)
Text Books	• R.S.AMBASHT : ECOLOGY • SUBHRAMANYAM AND SAMBHAMURTHI : ECOLOGY • ECOLOGY AND ENVIRONMENT – PD SHARMA • S C SANTRA – ENVIRONMENTAL SCIENCE
Reference Books	• E.P. ODUM: FUNDAMENTALS OF ECOLOGY , SAUNDERS (3RD EDITION) • PAUL COLINVAUX: ECOLOGY, JOHN WILEY AND SONS. • H.V. JADHAV - ENERGY AND ENVIRONMENT
E-resources	• https://www.classcentral.com/course/introduction-to-biology-110139 • https://www.classcentral.com/course/life-on-land-120864 • 1513594314ENV_P8_Module-1_e-text.pdf

Semester I PRACTICAL LAB-I	
Code of the Course	**EVS5000P**
Title of the Course	**Environment Basics Lab**
Credit of the course	04
Learning outcomes	To have basic knowledge of laboratory culture, ease of using instruments, handling glass wares and surrounding nature under study
EXPERIMENT DETAILS	
	1. To study the cleaning methods of glass wears. 2. To study the First-Aid and emergency treatment in laboratory. 3. Introduction to environmental lab and frequently used equipments – pH meter, hot air oven, scales, nails, weighing balance, burette, pipette, measuring cylinder, sieve set etc. 4. To study the preparation methods of reagents. 5. Study of effects of human interaction with natural environment around you 6. Describe the environmental problem of your locality and suggest a remedy. 7. Preparation of field report based on the survey of local flora.

	8. To record the following parameters of weather monitoring : • Maximum and minimum temperature (Outdoor, indoor) • Atmospheric Pressure • Rainfall • Temperature • Wind speed and Direction • Humidity • Light intensity
	SPOTTING : • Observations and comments on meteorological instruments and climate graphs
Reference Books	➢ J. Pandey and M. S. Sharma: Environmental Science: Practical and Field Manual, Yash Publications, Bikaner.
EoSE	• Internal assessment – 20 marks • External assessment- 80 marks ((Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks))

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Second Semester (Environmental Sciences)	
Code of the Course	**EVS5001T**
Title of the Course	**BASICS OF ENVIRONMENTAL BIOLOGY**
Qualification Level of the Course	NHEQF Level 4.5
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in EVS
Delivery type of the Course	Lecture, 40+20=60. The 40 lectures for content delivery and 20 hours on diagnostic assessment, formative assessment and subject/class activity,
Prerequisites	SCIENCE, biology stream of XII standard

Co-requisites	None
Objectives of the course	to develop the understanding of basics of the core subject
Learning outcomes	Have an idea about concept and components of environment and hierarchy in Environmental biology
Syllabus	
UNIT I	Introduction of Environmental Biology, its interdisciplinary nature; Concept of Ecosphere and Biosphere, Major biomes of the world: Forest, savannah, grassland, desert and tundra biomes. Flora and vegetation of India; vegetation of Rajasthan. (12 Lectures)
UNIT II	Ecological factors in relation to plants and animals – their concept, significance- light, temperature, topography, precipitation and edaphic variables. Ecological adaptation in plants- Xerophytes, hydrophytes, halophytes; their adaptations and ecotypes; Plant indicators. Animal fitness to habitats - fossorial, arboreal, aquatic and volant adaptations. Strategies of adaptation in plants and animals. (12 lectures)
UNIT III	Species ecology - Liebig's Law of the Minimum; Shelford's Law of Tolerance; Phenotypic plasticity; ecotypes; ecoclines; acclimation; ecological niche; types of niche: Eltonian niche, Hutchinsonian niche, fundamental niche, realized niche; thermoregulation; Interspecific interactions - Commensalism, Amensalism, Mutualism, Protocooperation, Symbiosis, Predation, Parasitism, Competition, Epiphytism; Types of association-Colonization, Aggregation, Social organization and behavior. (12 lectures)
UNIT IV	Population Ecology: Definition, characteristics; population dynamics- growth forms and concept of carrying capacity, population regulation. (12 lectures)
UNIT V	Community ecology - concept; characteristics- analytical characteristics - quantitative, qualitative and synthetic; IVI and concept of ecological dominance; Methods of studying vegetation, gradient analysis and continuum concept, ecotone and edge effect; Species diversity and indices; community classification; Ecological succession-Types, cause and processes, significance ; concept of climax. (12 lectures)
Text Books	• VERMA AND AGARWAL: ENVIRONMENTAL BIOLOGY. S.CHAND AND CO. RAM NAGAR, NEW DELHI. • P.D.SHARMA: ECOLOGY AND ENVIRONMENT, RASTOGI PUBLICATIONS, MEERUT. • K.C. AGARWAL: FUNDAMENTALS OF ENVIRONMENTAL BIOLOGY, NIDHI PUBLISHERS, BIKANER. • SUBHRAMANYAM - ECOLOGY • KS KOHLI – ENVIRONMENTAL BIOLOGY • BHARGAVRAJARAM – ECOLOGY AND ENVIRONMENT • SK DUBEY – ENVIRONMENTAL BIOLOGY
Reference Books	• V.B.RASTOGI: ANIMAL ECOLOGY, KEDARNATH RAMNATH, MEERUT. • JhokLro ,oa jko] i;kZoj.k vkSj ikfjfLFkfrdh] olqU/kjk izdk'ku] xkSj[kiqj A • TEXT BOOK OF PLANT ECOLOGY- R.S. AMBUSTHT

	• S.K. AGARWAL – ENVIRONMENTAL PROTECTION
E- reources	• 1513842523paper1_module_22_etext.pdf • 1532673767Paper01_Module1_etext.pdf • 1532673820paper01_Module2_etext.pdf

(Semester II) PRACTICAL LAB-II	
Code of the Course	**EVS5001P**
Title of the Course	**Field Ecology Lab I**
Credit of the course	04
Learning outcomes	To learn about field study with ecological units
EXPERIMENT DETAILS	
	I. To determine the minimum size of a quadrat for a grassland / forest by species area curve method. II. Determination of frequency by quadrat method III. Determination of density by quadrat method IV. Determination of abundance by quadrat method V. Determination of IVI with the help of Quadrat method. VI. To determine the index of dominance in a grassland community. VII. Determination of rate of production in a grassland community by harvest method VIII. Rapid field tests for pH, carbonate, nitrate and chloride.
	Spotting : • Economically important plants of forest origin (medicinal, timber Yielding, fiber yielding, resinous, petro plants, petro crops, energy weeds and other).
Reference Books	➢ J. Pandey and M. S. Sharma: Environmental Science: Practical and Field Manual, Yash Publications, Bikaner.
EoSE	• Internal assessment – 20 marks • External assessment- 80 marks ((Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks))

EXIT WITH CERTIFICATE

B.Sc. (Three Years Degree Program)	
Third semester (Environmental Sciences)	
Code of the Course	**EVS6002T**
Title of the Course	**ELEMENTS OF ECOSYSTEM ECOLOGY**
Qualification Level of the Course	NHEQF Level 5.0
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in EVS
Delivery type of the Course	Lecture, 40+20=60. The 40 lectures for content delivery and 20 hours on diagnostic assessment, formative assessment and subject/class activity, problem solving.
Prerequisites	Passed Certificate course in Environmental Sciences
Co-requisites	None
Objectives of the course	To understand the details of different ecosystems on earth
Learning outcomes	Understanding the relationship of several ecosystems and their balance with other components of environment
Syllabus	
UNIT I	Ecosystem – concept, its structure and function, homeostasis in the ecosystem; Energy flow in ecosystems, food chains, food webs, tropic levels, ecological pyramids, ecological efficiencies. (11 lectures)
UNIT II	Aquatic Ecology – Physico-chemical characteristics; lentic and lotic habitats; Definition and general account of lakes; origin of lakes, classification of lakes; Productivity and fertility of lakes; ecological zonation in the lake environment; Eutrophication. Biotic communities of lakes: Plankton, Benthos, Nekton and Neuston, Diversity and Biomass of plankton and benthos in time and space, aquaculture. (13 lectures)
UNIT III	Marine Ecology – Features of marine environment, zonation, biotic communities; Brief account of pelagic, coastal, deep sea, coral reefs and mangrove communities; Marine resources. Estuarine ecology- Definition and types, biota and productivity. Ecological adaptation in estuarine environment. (11 lectures)
UNIT IV	Terrestrial ecology- physico-chemical characteristics; Grassland ecosystem –main features, food chain and trophic levels, 10nergetic and productivity of grassland; biogeochemical cycles operating in grasslands; grass legume association; Grasslands in relation to soil and water conservation; Basis of grassland classification; Major grassland types in the world; grasslands in India with special reference to Rajasthan; Range management. (13 lectures)
UNIT V	Forest ecosystem – Major forest types of the world and of India; forest environment and zonation, food chains, 10nergetic and biogeochemical cycles operating in forest system, Forest biota. Desert ecosystem – Introduction to world deserts; climate of desert; Ecological adaptations of desert in plants and animals. Flora and fauna of Indian desert; causes of Desertification and control. (12 lectures)

Text Books	• P.D.SHARMA: ECOLOGY AND ENVIRONMENT, RASTOGI PUBLICATIONS, MEERUT. • SINGH, J.S., SINGH, S.P. & GUPTA, S.R. 2006. ECOLOGY, ENVIRONMENT AND RESOURCE CONSERVATION. ANAMAYA PUBLICATIONS. • HkkfV;k dksgyh ,oa Lo:I % I;kZoj.k tSfodh ds fofHkUu vk;ke] jes'k cqd fMiks] t;iqj
Reference Books	• FUNDAMENTALS OF ECOLOGY- M.C. DASH, TATA MCGRAW HILL PUB. • ENVIRONMENTAL SCIENCE – VAN CUNNINGHNN, TATA MCGRAW HILL PUB. • ECOLOGY BY WEIVER AND CLIMENTS • E.P. ODUM: FUNDAMENTALS OF ECOLOGY , SAUNDERS (3RD EDITION) • SWIFT, HEAL- STUDIES IN ECOLOGY VOL-5
E- resources	• https://onlinecourses.swayam2.ac.in/cec19_bt03/preview • https://www.classcentral.com/course/study-com-environment-and-humanity-111055

(Semester III) PRACTICAL LAB-III	
Code of the Course	**EVS6002P**
Title of the Course	**Field Ecology Lab II**
Credit of the course	04
Learning outcomes	To have basic knowledge of field data collection of different plant communities
EXPERIMENT DETAILS	
	i. To determine the frequency and density of vegetation by line transect method. ii. Determination of cover in a grassland community with the help of chart quadrat method. iii. Determination of DBH of the tree species in a forest and calculation of the basal area. iv. Characteristic adaptation of animals of ecological significance. v. Study of primary productivity in a grassland community (in terms of chlorophyll) in relation to light. vi. Study of external and internal adaptation and characteristics of important mesophytes and xerophytes.
	Spotting :

	• Common xerophytes • Mutualism-Lichens, Rhizobia, Mycorhizae • Commensalism-Lianas, Epiphytes • Parasitism-Cuscuta, Orobranchie, Loranthus. • Predation-Nepenthes, Drosera and Utricularia
Reference Books	➢ J. Pandey and M. S. Sharma: Environmental Science: Practical and Field Manual, Yash Publications, Bikaner.
EoSE	• Internal assessment – 20 marks • External assessment- 80 marks ((Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks))

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Fourth semester (Environmental Sciences)	
Code of the Course	**EVS6003T**
Title of the Course	**NATURAL PROCESSES OF EARTH AND CLIMATE CHANGE**
Qualification Level of the Course	NHEQF Level 5.0
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in EVS
Delivery type of the Course	Lecture, 40+20=60. The 40 lectures for content delivery and 20 hours on diagnostic assessment, formative assessment and subject/class activity,
Prerequisites	Passed Certificate course in Environmental Sciences
Co-requisites	None
Objectives of the course	• Evaluate characteristics of Environmental meteorology and factors related to geographical, geological and climate change • To analyze the geodynamic elements of earth.
Learning outcomes	Apply systems concepts and methodologies to analyze and understand interactions between different environmental and geological processes.

Syllabus	
UNIT I	Understanding the meteorological parameters and their characteristics -temperature, humidity, rainfall, wind speed and direction, sunshine, intensity, atmospheric pressure, cloud cover; scales of meteorology; forecasting of meteorological information (12 lectures)
UNIT II	Climatology: Elements of weather and climate, Climatic controls, Climatic variability and climate change. Elementary ideas about weather systems and their variations; Heat balance of the earth atmosphere system, Earth as a heat engine; Weather system: Tropical systems– equatorial trough, ITCZ, jet streams, vortices. (12 lectures)
UNIT III	Biogeochemical cycles with special reference to water, oxygen, nitrogen, carbon, phosphorus and sulphur. Clouds - definition, formation and types. Precipitation- types, forms (rain, drizzle, sleet, hail, snow) ; formation of precipitation, dew, fog and clouds; Atmospheric moisture, humidity, condensation; atmospheric stability, adiabatic process. Monsoon - Meaning, origin, Indian monsoon (Bay of Bengal branch and Arabian Sea branch) and significance. El-Nino, La-Nina- concept and mechanism. (12 lectures)
UNIT IV	Earth and sun relations - rotation, revolution and seasons; Energy, radiation, temperature and heat; Solar radiation - Concept of insolation and heat budget. Pressure- pressure belts, wind and Atmospheric circulation. Temperature – Horizontal distribution, lapse rate - concept and types; Temperature inversion - concept and types, Humidity -definition and types. Wind - origin and Earth's surface wind system (doldrums, trade wind belt, prevailing westerlies, and polar easterlies). (12 lectures)
UNIT V	Climate classification of world; Climate of India: Physiography, spatial and temporal patterns of climatic parameters - temperature, rainfall and its variability in India with special reference to NE India. (12 lectures)
Text Books	• PRINCIPLES OF ECOLOGY P. S. VERMA,V. K. AGARWAL (S. CHAND AND CO. NEW DELHI) • ECOLOGY AND ENVIRONMENT BY P.D. SHARMA • A. K. DE – ENVIRONMENTAL CHEMISTRY • CLIMATOLOGY – SAVINDRA SINGH
Reference Books	• KELLER, E.A. 2011. INTRODUCTION TO ENVIRONMENTAL GEOLOGY (5TH EDITION). PEARSON PRENTICE HALL. • MANAHAN, S.E. 2010. ENVIRONMENTAL CHEMISTRY. CRC PRESS, TAYLOR AND FRANCIS GROUP. • ENVIRONMENTAL SCIENCE, DANIAL BOTKIN AND EDWARD KELLER. JOHN WILEY AND SONS, NEW YORK • FUNDAMENTALS OF ECOLOGY BY E.P. ODUM. • PETER O'NEIL - ENVIRONMENTAL CHEMISTRY • PETER V HOBLES – INTRODUCTION OF ATMOSPHERE CHEMISTRY • S.K. AGARWAL – ENVIRONMENTAL PROTECTION
E- resources	• 1518523177ENV_P8_Module-3_e-text.pdf • 1513921840ENV_P8_Module-12_e-text.pdf • 1519276336ENV_P8_Module-19_e-text.pdf • 1520397151paper8_Module-18_e-text.pdf

(Semester IV) PRACTICAL LAB-IV	
Code of the Course	**EVS6003P**
Title of the Course	**Water Analysis Lab**
Credit of the course	04
Learning outcomes	To have basic knowledge of sampling techniques, equipments and physico- chemical analysis of water samples
EXPERIMENT DETAILS	
	I. Measurement of depth of visibility in a lake or pond with the help of a Secchi disc. II. Studies of water samples for : a. pH and color b. Dissolved oxygen c. Total Alkalinity d. Total hardness e. Chlorides f. Dissolved organic carbon g. Suspended particulates- TDS/TSS h. Turbidity and Conductivity i. Nitrates j. Phosphates k. BOD III. Observation and ecological significance of zooplanktons and phytoplanktons, benthos, nektons and macrophytes in lake waters IV. Estimation of primary productivity with the help of dark and light bottle experiment.
	SPOTTING : • Sampling equipments- plankton net, sacchi disk, BOD bottle, periphyton sampler, Van dorn and grab sampler • Study of external and internal adaptation and characteristics of important hydrophytes • Aquarium as an artificial/ man-made ecosystem. • Field visit to any biodiversity park/wetland/solar plants/biogas plant and record observations

Reference Books	➢ J. Pandey and M. S. Sharma: Environmental Science: Practical and Field Manual, Yash Publications, Bikaner.
EoSE	• Internal assessment – 20 marks • External assessment- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)

(Semester IV) SKILL ENHANCEMENT COURSE	
Code of the Course	**SES6340T**
Title of the Course	**Ecotourism and Wildlife Conservation**
Qualification Level of the Course	NHEQF Level 5.0
Credit of the course	2
Type of the course	Skill enhancement course (SES) in Environmental Sciences
Delivery type of the Course	Lecture, 20+10=30. The 20 lectures for content delivery and 10 hours on tutorial assessment, formative assessment and subject/class activity,
Objectives of the course	To have basic knowledge of ecotourism ,wild life and sustainable practices as career opportunity
Learning outcomes	Student will be able to have basic understanding of sustainable practices in ecotourism and wildlife conservation aspect
Syllabus	
UNIT I	**Introduction to Ecotourism and Wildlife Conservation** : overview and principles of ecotourism; ecotourism and its role in conservation; major threats to wildlife and tourism; conservation approaches and strategies. (6 Lectures)
UNIT II	**Wildlife Conservation**: wildlife ecology and behaviour; conservation genetics; habitat conservation and restoration ; protected areas and their significance; human-wildlife conflict resolution (6 Lectures)
UNIT III	**Sustainable Tourism Practices**: sustainable tourism principles; sustainable tourism development ;community-based tourism ; ecotourism marketing and promotion ; visitor management and safety; interpretation and education programs. (6 Lectures)
UNIT IV	**Case Studies in Ecotourism and Conservation** : successful ecotourism initiatives ; lessons learned from failed initiatives ; international case studies ; local ecotourism examples; analyzing the impact of tourism on

	local communities and protected ecosystems. (6 Lectures)
UNIT V	**Conservation Policy and Future Directions** : conservation policy and legislation ; international conservation agreements (e.g., cites, CBD) ;ecotourism's role in policy advocacy ; emerging trends in ecotourism and conservation ;future challenges and opportunities (6 Lectures)
Reference Books	• ENVIRONMENTAL WILDLIFE AND PLANT CONSERVATION – PR TRIVEDI • ECOTOURISM DEVELOPMENT AND MANAGEMENT- B.B.HOSITILE • CUMULATIVE EFFECTS IN WILDLIFE- PAUL R. KRAUSMAN • Indian ecotourism-Ratandeep Singh • National Ecotourism-Ratandeep Singh
E –resources	• https://onlinecourses.swayam2.ac.in/cec23_ge16/preview • Ecotourism_Principles,PracticesandPoliciesforSustainability-2002518.pdf • 1468994922P06-M29-NatureEcoTourism-ET.pdf • 9780203382110 (e-book)

EXIT WITH B. Sc. DIPLOMA

B.Sc. (Three Years Degree Program)	
FIFTH SEMESTER	
Subject-Environmental Sciences	
Code of the Course	**EVS7100T**
Title of the Course	**POLLUTION ECOLOGY**
Qualification Level of the Course	NHEQF Level 5.5
Credit of the course	4
Type of the course	Discipline Specific Elective Course (DSE) in EVS
Delivery type of the Course	Lecture, 40+20=60. The 40 lectures for content delivery and 20 hours on diagnostic assessment, formative assessment and subject/class activity,
Prerequisites	Having B.Sc. diploma in environmental sciences

Co-requisites	None
Objectives of the course	• Perform procedure for qualitative and quantitative analysis of pollutants. • Assess the effects of pollutants and suggest the control and preventive measures for environment.
Learning outcomes	Identify sources, nature and effects of pollutants on global and local environment
Syllabus	
UNIT I	Definition of pollution; pollutants- their classification, Solubility (hydrophilic and lipophilic pollutants), transfer of pollutants within different mediums, role of chelating agents in transferring pollutants, concept of biotransformation and bioaccumulation; concept of radioactivity, radioactive decay and half-life of pollutants, organometallic compounds, acid mine drainage (12 Lectures)
UNIT II	Ambient air quality- monitoring and standards (National Ambient Air Quality Standards of India); Air quality index; sources and types of air pollutants (primary and secondary), smog; effects of different pollutants on human health (NOx, SOx, PM, CO, CO2, hydrocarbons and VOCs) and control measures; indoor air pollution: sources and effects on human health. Acid rain, Fly ash, Aerosols, Green House Effect, global warming (12 Lectures)
UNIT III	Water pollution – kinds (municipal water pollution, municipal sewers and sewage; Industrial and commercial water pollution); Safe drinking water; water quality parameters and standards; Sources of surface and ground water pollution; organic waste and eutrophication; COD, BOD, DO; effect of water contaminants on human health (nitrate, fluoride, arsenic, chlorine, cadmium, mercury, pesticides); water borne diseases (12 Lectures)
UNIT IV	Land Pollution – Effects of agrochemicals – herbicides, pesticides and fertilizers; Mining and smelting. Radioactive pollution – Radiation and their types – non- ionizing and ionizing radiations; sources in environment, effects on man, animals and plants; Prevention. Causes of soil pollution and degradation; effect of soil pollution on environment, vegetation and other life forms; control strategies. (12 Lectures)
UNIT V	Noise pollution – sources; frequency, intensity and permissible ambient noise levels; effect on communication, impacts on life forms and humans - working efficiency, physical and mental health; control measures. Radioactive material and sources of radioactive pollution; effect of radiation on human health (somatic and genetic effects); Thermal pollution and its effects. Marine resources and their importance; sources of marine pollution; oil spill and its effects; coral reefs and their demise; coastal area management (12 Lectures)
Text Books	• K.C.AGARWAL: ENVIRONMENTAL POLLUTION - CAUSES EFFECTS AND CONTROL, NIDHI PUBLISHERS, BIKANER. • ENVIRONMENTAL POLLUTION - TIMMY KATYAL • M.P. SINGH - ENVIRONMENT AND POLLUTION • PUROHIT AND AGARWAL – ENVIRONMENTAL POLLUTION • G. R. CHATTWAL – ENVIRONMENTAL LAND AND MARINE POLLUTION AND CONTROL

Reference Books	• ENVIRONMENTAL POLLUTION CAUSES EFFECTS AND CONTROL –PUROHIT AGARWAL • POLLUTION CONTROL AND ENVIRONMENTAL MANAGEMENT – NIKHIL MUKHERJEE
E resources	• 1519193193paper10_Module3e-text.pdf • 1519217205paper10_module30_module_30_etext.pdf

(Semester V) PRACTICAL LAB-V	
Code of the Course	**EVS7100P**
Title of the Course	**Pollution Analysis Lab**
Credit of the course	04
Learning outcomes	To have basic knowledge of sampling techniques and physico- chemical analysis of pollutants
EXPERIMENT DETAILS	
	Study of ambient air quality with respect to : I. SPM- 10 and 2.5 II. SOx (sulphur oxides) III. NOx (nitrogen oxides) IV. O_3 (ozone) V. CO (carbon mono oxide) VI. CH_4 (Methane) VII. Bio aerosols VIII. Detection and estimation of noise monitoring in silent, residential and commercial zones IX. To prepare a report on the effect of local industrial activities on human health X. Visit to an industry having air-pollution control measures and reporting
	Spotting: I. Basic sampling and analysis equipments of air and soil (HVS, RDS, CO AND METHANE ANALYSER, SEIVE SET) II. Principle , construction and working of Sound level meter
Reference Books	➢ J. Pandey and M. S. Sharma: Environmental Science: Practical and Field Manual, Yash Publications, Bikaner.

EoSE	• Internal assessment – 20 marks • External assessment- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)

FIFTH SEMESTER	
Subject-Environmental Sciences	
Code of the Course	**EVS7101T**
Title of the Course	**TOXICOLOGY**
Qualification Level of the Course	NHEQF Level 5.5
Credit of the course	4
Type of the course	Discipline Specific Elective Course (DSE) in EVS
Delivery type of the Course	Lecture, 40+20=60. The 40 lectures for content delivery and 20 hours on diagnostic assessment, formative assessment and subject/class activity,
Prerequisites	Having B.Sc. diploma in environmental sciences
Co-requisites	None
Objectives of the course	To have awareness of natural toxicity, toxic components and their magnification in environment
Learning outcomes	Have concept of toxicity of contaminants present in environment and their detrimental impacts
Syllabus	
UNIT I	Definition of Toxicology, toxic substances in the environment; Concept of dose-response relationship; acute toxicity, chronic toxicity, lethal concentration, effective concentration, median tolerance limits . (12 Lectures)
UNIT II	Metabolism of toxic substances by animals – uptake, excretion, chemical localization and its consequences; hepatic metabolism; Synergistic and Antagonistic effects. (13 Lectures)
UNIT III	Metabolism of toxic substances by plant – uptake, translocation, metabolism and excretion, pathogen toxins, herbicides; Atmospheric toxicants and plants; Algal toxins, Mycotoxins. (13 Lectures)
UNIT IV	Environmental factors in human health; Occupational hazards and diseases and their prevention. Food poisoning, toxicity of drugs, antibiotics, pesticides, metals; drug allergies (11 Lectures)
UNIT V	Teratogenecity, carcinogenesis and brief idea of genotoxicity Fumacatories and masticatories – sources, uses, effects on human body and evil effects on the society. (11 Lectures)
Text Books	• P.D.SHARMA : ENVIRONMENTAL TOXICOLOGY • M. SATAKE – ENVIRONMENTAL TOXICOLOGY

	• BS YADAV – ENVIRONMENT BIOLOGY AND TOXICOLOGY
Reference Books	• PHILLEP L. WILLIAMS – PRINCIPAL OF TOXICOLOGY • ECOTOXICOLOGY AND ENVIRONMENTAL CHEMISTRY – GISELLE TANG • ROSEMARY CHARLES- ENVIRONMENTAL TOXICOLOGY AND POLLUTION • RAVENN BRENNAN – ENVIRONMENTAL HEALTH AND TOXICOLOGY
E -resources	• A textbook of Modern Toxicology.pdf • A Textbook of Modern Toxicology- Editor(s):Ernest Hodgson, Online ISBN:9780471646778, 2004 John Wiley & Sons, Inc. • https://www.atsdr.cdc.gov/training/toxmanual/pdf/module-1.pdf
(Semester V) PRACTICAL LAB-V	
Code of the Course	**EVS7101P**
Title of the Course	**Toxicology Lab**
Credit of the course	04
Learning outcomes	To have basic knowledge of toxicants and their analysis
EXPERIMENT DETAILS	
	I. Quantitative estimation of carbonate / bicarbonates / chlorides II. Estimation of percentage of calcium carbonate by rapid titration method III. Plant bio essays – morphology, chlorophyll (A, B and total), ascorbic acid, proteins, carbohydrates, etc. IV. To study the effect of certain toxicants on the chromosomes of Tradescantia / Onion. V. Determination of soil structure VI. Determination of soil texture VII. Identification and ecological significance of Soil organisms – flora, bacteria ,fungi VIII. Study of soil microbial activity IX. Submission of field report on visit to a water treatment site, its sampling and analysis X. Visit to an STP or ETP site and submission of observations on its principal and working
	Spotting: Based on the experiments
Reference Books	➢ J. Pandey and M. S. Sharma: Environmental Science: Practical and Field Manual, Yash

	Publications, Bikaner.
EoSE	• Internal assessment – 20 marks • External assessment- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)
(Semester V) SKILL ENHANCEMENT COURSE	
Code of the Course	**SES7341T**
Title of the Course	**FIRE HAZARD AND MANAGEMENT IN INDUSTRY**
Qualification Level of the Course	NHEQF Level 5.5
Credit of the course	02
Type of the course	Skill enhancement course (SES) in Environmental Sciences
Delivery type of the Course	Lecture, 20+10=30. The 20 lectures for content delivery and 10 hours on tutorial assessment, formative assessment and subject/class activity,
Objectives of the course	To learn about fire as serious industrial hazard and its abatement measures
Learning outcomes	Student will be able to understand and learn the skill to mitigate the hazards related to occupational injury i.e. fire, its associated risk factors and related preventive Practices
Syllabus	
UNIT I	**Introduction to Fire and Safety :** Introduction to fire and safety in industrial settings; Historical perspective of industrial fires and accidents; Fire and safety regulations and standards; Fire triangle and basic fire chemistry; Common fire hazards in industries. (6 lectures)
UNIT II	**Fire Prevention and Risk Assessment:** Principles of fire prevention and risk assessment; Hazard identification and risk analysis; Fire safety management systems; Emergency planning and evacuation procedures; Fire prevention strategies and practices in industries. (6 lectures)
UNIT III	**Fire Detection and Suppression Systems :** Types of fire detection systems (heat, smoke, flame detectors);Fire alarm systems and their components; Fire suppression methods (water-based, gas-based, foam systems); Firefighting equipment and their usage; Inspection and maintenance of fire detection and suppression systems. (6 lectures)
UNIT IV	**Industrial Safety Practices :**Industrial safety regulations and compliance; Personal protective equipment (PPE) and its selection; Safety training and awareness programs; Hazardous materials handling and storage;

	Accident investigation and reporting. (6 lectures)
UNIT V	**Emergency Response and Crisis Management :**Emergency response plans and procedures; Evacuation drills and procedures; Crisis communication and coordination; Post-incident analysis and improvement. (6 lectures)
Reference Books	• Disaster management Vol 1 -G.K.Ghosh
E- resources	• epdf.pub_fire-hazards-in-industry.pdf • Handbook of Fire and Explosion Protection Engineering Principles: for Oil, Gas, Chemical and Related Facilities by Dennis P. Nolan , publisher - Elsevier Science, ISBN-**9781437778588** • Fire Safety Management Handbook Third Edition By Daniel E Della Giustina-watermark.pdf

B.Sc. (Three Years Degree Program)	
SIXTH SEMESTER	
Subject-Environmental Sciences	
Code of the Course	**EVS7102T**
Title of the Course	**NATURAL RESOURCE CONSERVATION**
Qualification Level of the Course	NHEQF Level 5.5
Credit of the course	4
Type of the course	Discipline Specific Elective Course (DSE) in EVS
Delivery type of the Course	Lecture, 40+20=60. The 40 lectures for content delivery and 20 hours on diagnostic assessment, formative assessment and subject/class activity
Prerequisites	Having B.Sc. diploma in environmental sciences
Co-requisites	None
Objectives of the course	Gain in-depth knowledge about the concept of ecosystem and natural resources
Learning outcomes	• Apply the environmental conservation strategies. • Develop professional knowledge in the areas of biodiversity conservation and natural resource management. • Critically assess different natural resource management projects, policies and planning at different levels.

Syllabus	
UNIT I	Natural resources and reserves; classification of natural resources; renewable and non-renewable resources; resource degradation; resource conservation; resource availability and factors influencing its availability; Human impact on natural resources; ecological, social and economic dimension of resource management. (11 Lectures)
UNIT II	Land as a resource – types; drivers of land degradation - deforestation, desertification; habitat loss, loss of biodiversity; land salinization; human population pressure, poverty, socio-economic and institutional factors; visual indicators of land degradation. (11 Lectures)
UNIT III	Mineral resources and the rock cycle; identified resources; undiscovered resources; reserves; types of mining-surface, subsurface, open-pit, dredging, strip; reserve-to-production ratio; global consumption patterns of mineral resources ; techniques to increase mineral resource supplies; ocean mining for mineral resources; environmental effects of extracting and using mineral resources. (13 Lectures)
UNIT IV	Forest resources: economic and ecological importance of forests, forest management strategies, sustainable forestry; Symbiotic relationship between tribals and forest, community participation in forest management; case study of Chipko movement; sacred groves forests; India's Bishnoi community and their conservation practices; conservation of indigenous culture and traditions. Water resources: supply, renewal and use of water resources, freshwater shortages, strategies of water conservation; fisheries and other marine resources; aquaculture. (13 Lectures)
UNIT V	Soil - ecological and economic importance of soil; types and causes of soil degradation; impact of soil loss and soil degradation on agriculture and food security; need for soil conservation and restoration of soil fertility. Range management and their conservation; range land degradation. Food resources: world food problem, techniques to increase world food production, green revolution. (12 Lectures)
Text Books	• V. RAGHUPATHY – NATURAL RESOURCES • ENVIRONMENTAL AWARENESS – ANNETTE BALGARE • ENVIRONMENTAL ENERGY RESOURCES –SR MANJUNATHA • Jerry L. Holechek cale, Fisher- Natural Resources
Reference Books	• F.RANADE (1984): ECOLOGY OF NATURAL RESOURCES, JOHN WILEY AND SONS SINGAPORE. • KLEE, G.A. 1991. CONSERVATION OF NATURAL RESOURCES. PRENTICE HALL PUBLICATION. • KNOW ALL ABOUT REDUCE, REUSE AND RECYCLE - YOOFISACA
e-resources	• https://www.ugc.gov.in/oldpdf/modelcurriculum/Chapter2.pdf • https://profilelogin.admissione.online/UploadFiles/Documents/ProfileLgoin/Subtitle/NColge_1372_Natural%20Resource%20Management%20Physical%20and%20Biotic.pdf • https://egyankosh.ac.in/bitstream/123456789/83163/1/Unit-12.pdf

(Semester VI) PRACTICAL LAB-VI	
Code of the Course	**EVS7102P**
Title of the Course	**Soil Analysis Lab**
Credit of the course	04
Learning outcomes	To have basic knowledge of soil and its analysis
EXPERIMENT DETAILS	
	I. Study of physical characteristics of soil with particular reference to : a. Porosity and Bulk density b. Air content c. Water holding capacity d. pH and Conductivity **e.** Determination of soil moisture **f.** Study of soil profile **g.** Wilting coefficient and specific gravity **a.** Determination of soil organic matter b. Total nitrogen c. Sulphate-sulphur d. Available phosphorus
	Spotting: Based on the experiments
Reference Books	➢ J. Pandey and M. S. Sharma: Environmental Science: Practical and Field Manual, Yash Publications, Bikaner.

EoSE	• Internal assessment – 20 marks • External assessment- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)

OR

SIXTH SEMESTER (Environmental Sciences)	
Code of the Course	**EVS7103T**
Title of the Course	**BIODIVERSITY CONSERVATION**
Qualification Level of the Course	NHEQF Level 5.5
Credit of the course	4
Type of the course	Discipline Specific Elective Course (DSE) in EVS
Delivery type of the Course	Lecture, 40+20=60. The 40 lectures for content delivery and 20 hours on diagnostic assessment, formative assessment and subject/class activity
Prerequisites	Having B.Sc. diploma in environmental sciences
Co-requisites	None
Objectives of the course	To sensitize students towards basics of biodiversity in India and world and its conservation
Learning outcomes	Have developed an understanding of the biodiversity resources, its economic value, wildlife and their conflicts, the pressures faced by habitat loss, man and animal conflicts and cultivate an insight into the conservation practices.
Syllabus	
UNIT I	Concept of biological diversity; biodiversity hotspots; India as a mega diversity nation; phytogeographic and zoogeographic zones of the country; National Biodiversity Action Plan. (12 Lectures)
UNIT II	Interpretive phytogeography. Endemic areas and theories of endemism; Endemic flora of India. Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Ethiopian, Oriental, Australian region, Dynamic biogeography – Dispersal dynamics, barriers, dispersal pathways, continental drift theory, land bridge, centre of origin, age and area hypothesis; Migration. (12 Lectures)
UNIT III	Threats to biodiversity: Natural and anthropogenic disturbances; habitat loss, habitat degradation and habitat fragmentation; Impact of climate change, pollution, invasive species, hunting, over-exploitation, land use changes, overgrazing, hydropower development and deforestation; man wildlife conflicts; consequences of biodiversity loss; Intermediate Disturbance Hypothesis. (12 Lectures)

UNIT IV	Conservation of biological diversity- In-situ conservation (Biosphere Reserves, National Parks, Wildlife Sanctuaries); Ex-situ conservation(botanical gardens, zoological gardens, gene banks, seed and seedling banks, pollen culture, tissue culture and DNA banks), role of local communities and traditional knowledge in conservation. Biodiversity hotspots; IUCN Red List categorization – guidelines, practice and application; Red Databook; ecological restoration; afforestation; social forestry; agro forestry; joint forest management. (12 Lectures)
UNIT V	Economic values of biodiversity – social, aesthetic, consumptive, and ethical values of biodiversity; Eco-conservation of Aravali; Role of UNEP, IUCN, ELC and WWF in conservation of nature and natural resources; scheme and labeling of environment friendly products, Ecomarks; Article 48A; Article 51 A; Stockholm Conference 1972, Rio Declaration, Agenda 21, Montreal Protocol 1987; Kyoto Protocol 1997; Copenhagen and Paris summits; Ramsar convention. (12 Lectures)
Text Books	• ECOLOGY, ENVIRONMENT AND RESOURCE CONSERVATION. SINGH, J. S., SINGH, S.P. & GUPTA, S. 2006.ANAMAYA PUBLICATIONS, NEW DELHI. • GLOBAL BIODIVERSITY – PC TRIVEDI • ENVIRONMENTAL WILDLIFE AND PLANT CONSERVATION – PR TRIVEDI • SUBHRAMANYAM & SAMBAMURTY- ECOLOGY • ECOLOGY AND ENVIRONMENT – PD SHARMA • SC SANTRA – ENVIRONMENTAL SCIENCE
Reference Books	• An Advanced Text Book of Biodiversity - Principles and Practices. Krishnamurthy, K.V. 2004. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi. • BIORESOURCE AND GENEPOOL CONSERVATION – MP SINGH
E resources	• 1522990853Paper03_Module01_etext.pdf • 1532682471Paper_03_Module_02_etext.pdf • 1519195812Paper03_Module15_etext.pdf • 1520337549Paper03_Module18_etext.pdf

(Semester VI) PRACTICAL LAB-VI	
Code of the Course	**EVS7103P**
Title of the Course	**Biodiversity Lab**

Credit of the course	04
Learning outcomes	To have basic knowledge of soil and its analysis
EXPERIMENT DETAILS	
	I. To demonstrate use of solar devices, photo-cells and wind-mills. II. To describe construction, working and significance of Biogas plant III. To demonstrate the extraction process of forest products. IV. Ecological observations on life cycle of some economically important insects. V. Identification of museum specimens of some economically important fishes. VI. Study of regional and Indian subcontinent flora and fauna through charts and maps. VII. Temporary slide preparation of given flora or fauna VIII. Comments on plants and animals of ecological significance IX. Study of preparation method of compost and vermicompost
	Spotting: Based on the experiments
Reference Books	➢ J. Pandey and M. S. Sharma: Environmental Science: Practical and Field Manual, Yash Publications, Bikaner.
EoSE	• Internal assessment – 20 marks • External assessment- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)

Or

SIXTH SEMESTER (Environmental Sciences)	
Code of the Course	**EVS7104T**
Title of the Course	**WASTE MANAGEMENT**
Qualification Level of the Course	NHEQF Level 5.5

Credit of the course	4
Type of the course	Discipline Specific Elective Course (DSE) in EVS
Delivery type of the Course	Lecture, 40+20=60. The 40 lectures for content delivery and 20 hours on diagnostic assessment, formative assessment and subject/class activity, problem solving.
Prerequisites	Having B.Sc. diploma in environmental sciences
Co-requisites	None
Objectives of the course	To develop knowledge of quantification and characteristics of solid waste and their management. Be able to understand the handling techniques and legislations governing wastes.
Learning outcomes	Develop skills required for managing different kinds of solid wastes.
Syllabus	
UNIT I	Solid waste - Source and generation, their classification and chemical composition; characterization of municipal solid waste, hazardous waste and biomedical waste; Impact of solid waste on environment, humans and plant health; Effect of solid waste and industrial effluent discharge on water quality and aquatic life; Mining waste and land degradation; Effect of landfill leachate on soil characteristics and ground water pollution. (12 Lectures)
UNIT II	Different techniques used in collection, storage, transportation and disposal of solid waste (municipal, hazardous and biomedical waste); Landfill (traditional and sanitary landfill design); Thermal treatment (pyrolysis and incineration) of waste material; Drawbacks in waste management techniques. (12 Lectures)
UNIT III	Types of industrial waste- hazardous and non-hazardous; effect of industrial waste on air, water and soil; Industrial waste management and its importance; Stack emission control and emission monitoring; Effluent treatment plant and Sewage treatment plant (12 Lectures)
UNIT IV	4R- reduce, reuse, recycle and recover; Biological processing - composting, anaerobic digestion, aerobic treatment; reductive dehalogenation; mechanical biological treatment; green techniques for waste treatment; Concept of energy recovery from waste; refuse derived fuel (RDF); different WTE processes: combustion, pyrolysis, landfill gas (LFG) recovery; anaerobic digestion; gasification. (12 Lectures)
UNIT V	Concept of Integrated waste management; waste management hierarchy; methods and importance of Integrated waste management. Municipal Solid Wastes (Management and Handling) Rules 2000; Hazardous Wastes Management and Handling Rules 1989; Bio-Medical Waste (Management and Handling) Rules 1998; Eco friendly or green products (12 Lectures)
Text Books	• WASTE MANAGEMENT – RAJIV K SINHA 1. RAKESH KUMAR- MUNICIPAL WATER AND WASTE WATER TREATMENT

Reference Books	• INTEGRATED SOLID WASTEMANAGEMENT: A LIFE CYCLE INVENTORY. MCDOUGALL, F. R., WHITE, P. R., FRANKE, M., & HINDLE, P. 2008. JOHN WILEY & SONS. • INDUSTRIAL WASTES – WILLE RUDOLFS
	• 1511172529Paper_11_module_1_yoga_etext.pdf • 1522921989paper11_module_4_etext.pdf • 1511170431Paper_11_module_31_yoga_etext.pdf

(Semester VI) PRACTICAL LAB-VI	
Code of the Course	**EVS7104P**
Title of the Course	**Waste Analysis Lab**
Credit of the course	04
Learning outcomes	To have basic knowledge of wastes,its analysis and their mitigation process
EXPERIMENT DETAILS	
	I. To segregate domestic waste into bio-degradable and non-biodegradable components II. Sampling and chemical analysis of wastewater/polluted soil/sediment III. To visit a solid-waste management site and record observations IV. To visit a waste- water management site and prepare a report V. To prepare a report on various types of local industrial effluents VI. Choose five common species of Trees / plants from your NEIGHBORHOOD and list their common and scientific names. Describe each plant in terms of its ecological significance VII. To study local sources and types of industrial waste. VIII. Visit to waste water treatment plant and submission of report
	Spotting: Based on the experiments

Reference Books	➢ J. Pandey and M. S. Sharma: Environmental Science: Practical and Field Manual, Yash Publications, Bikaner.
EoSE	• Internal assessment – 20 marks • External assessment- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)
(Semester VI) SKILL ENHANCEMENT COURSE	
Code of the Course	**SES7342T**
Title of the Course	**Industrial health and Safety**
Qualification Level of the Course	NHEQF Level 5.5
Credit of the course	02
Type of the course	Skill enhancement course (SES) in Environmental Sciences
Delivery type of the Course	Lecture, 20+10=30. The 20 lectures for content delivery and 10 hours on tutorial assessment, formative assessment and subject/class activity,
Objectives of the course	To learn about the work ethics and safety in industrial set up
Learning outcomes	One can be well aware of occupational health hazards, safety practices and an emerging concept of industry
Syllabus	
UNIT I	**Introduction to Health and Safety in Industries :** Understanding the Significance of Health and Safety in Industrial Settings; Historical Overview of Industrial Accidents and Their Impact ; Legislation and Regulatory Framework for Industrial Health and Safety ; Roles and Responsibilities of Employers, Employees, and Regulatory Bodies ;Safety Culture and Its Influence on Workplace Safety ;Risk Assessment and Hazard Identification in Industrial Environments . (6 lectures)
UNIT II	**Occupational Health and Hygiene in Industries:** Common Occupational Health Hazards: Chemical, Physical, Biological, Ergonomic, and Psychosocial ; Methods for Assessing and Monitoring Workplace Exposures ;Occupational Diseases and Disorders: Causes, Symptoms, and Prevention ; Control Measures- Personal Protective Equipment (PPE), Ventilation and Engineering Controls ; Occupational Health Programs, Medical Surveillance, and Wellness Initiatives ;Case Studies on Occupational Health Challenges in Various Industries. (6 lectures)

UNIT III	**Industrial Safety Practices and Procedures :** Safe Work Practices and Procedures in Industrial Settings ; Fire Safety and Emergency Response Planning; Safe Handling and Storage of Hazardous Materials ; Machine and Equipment Safety: Guarding, Lockout/Tagout, and Maintenance; Electrical Safety Measures ; Confined Space Entry, Working at Heights, and Hot Work Safety; Real-life Case Studies on Industrial Accidents and Their Root Causes. (6 lectures)
UNIT IV	**Safety Management Systems (SMS) and Compliance :** Introduction to Safety Management Systems (SMS); Key Elements of SMS: Policy, Planning, Implementation, Monitoring and Review; Conducting Safety Audits and Inspections ;Incident Investigation and Reporting Protocols ; Occupational Safety Training and Communication Strategies ;Promoting a Culture of Safety and Compliance with Regulatory Standards ;Case Studies on Successful Implementation of SMS in Industries . (6 lectures)
UNIT V	**Emerging Trends in Industrial Health and Safety :** Contemporary Challenges in Industrial Health and Safety ; Sustainable and Green Practices in Industrial Safety; Technological Advancements and Their Impact on Workplace Safety; International Standards and Best Practices in Industrial Safety; Crisis and Risk Management in Industrial Environments . (6 lectures)
Reference Books	• ENVIRONMENTAL MANAGEMENT- UBEROI • ENVIRONMENTAL SAFETY AND HEALTH ENGINEERING- GAYLE WOODSIDE • ENVIRONMENTAL MANAGEMENT- S.GAUR • ENVIRONMENT & HEALTH EFFECTS- ETIENNE DUBAIS
E resources	• https://www.academia.edu/26807812/Oxford_Handook_of_Occupational_Health_2nd_Ed • https://ftp.idu.ac.id/wp-content/uploads/ebook/ip/BUKU%20MANAJEMEN%20SAFETY/SAFETY%20INDUSTRY/ • https://www.free-safety-training.com/product/occupational-health-and-safety-books-pdf/
EXIT WITH B.Sc. DEGREE	