

SYLLABUS AND SCHEME OF EXAMINATION

For

M. Sc. (PG) PROGRAMME

(As per NEP 2020 Scheme)



DEPARTMENT OF ENVIRONMENTAL SCIENCES

FACULTY OF EARTH SCIENCE

M. L. SUKHADIA UNIVERSITY

Udaipur

Session: 2023-24

CBCS COURSE STRUCTURE AS PER NEP GUIDELINES

Table 1: CBCS Course structure for M.Sc. (Two Year Program), Total credits 96.				
	SEM-I	SEM-II	SEM-III	SEM-IV
Core Courses	DCC-1-Th (4 Cr) DCC-2 Th (4 Cr) DCC-3 Th (4 Cr) DCC-4 Th (4 Cr) DCC-1Lab (4 Cr) DCC-2Lab (4 Cr)	DCC-5-Th (4 Cr) DCC-6 Th (4 Cr) DCC-7 Th (4 Cr) DCC-3 Lab (4 Cr) DCC -4 Lab (4 Cr)	DCC-8-Th (4 Cr) DCC-9 Th (4 Cr)	DCC-10-Th (4 Cr)
Discipline Specific Elective/ Generic Elective Courses	-	GEC- Th (4 Cr)	DSE- 1Th (4 Cr) DSE- 2Th (4 Cr) DSE-3 Lab (4 Cr) DSE-4 Lab (4 Cr)	DSE- Th (4 Cr) DSE-(17-20) Th (4 Cr) DSE-(21-24) Th (4 Cr) DSE-(9-12) Lab (4 Cr) DSE-(13-16) Lab (4 Cr)
	24+00=24	20+4=24	8+16=24	4+20=24
	56(DCC)+40(DSE/GEC)=96			

1. **Discipline Specific Elective (DSE):** In this table four electives are proposed for a given DSE/GEC course (in the parentheses note the 4 options of each elective i.e. 1-4, or 5-8 or 13-16 etc). Currently, at least two i.e. the first two are to be proposed in each of the ten DSE/GEC courses. Two additional numbers are reserved for two more electives which may be proposed in future.
2. A DSE course opted by a student from his/her parent Department, will be the DSE for him/her. Else the course will be the GEC.
3. A student can opt 2-3 GEC which are under the DSE courses of other faculty.
4. Wherever there are only theory papers the courses can be of either 6 or 4 credits only. . In case of 6 credit for each course the number of courses given in above table will reduce accordingly.
5. In some of the disciplines it can be (2L+2P+2T) or (2L+4P).

M. Sc. CBCS CURRICULUM (PG403XX)
(UNDER NEP)
for Environmental Sciences, 2023-24
Semester I

S. no	COURSE TYPE	Course code	Title of course	L-T-P	NO. OF CREDITS	MAX. MARKS		TOTAL
						UNI. EXAMS	INT.ASSESSMENT	
1	DCC	EVS8000T	Basic concepts of ecology and environment	4-0-0	4	80	20	100
2	DCC	EVS8001T	Earth processes and natural cycles	4-0-0	4	80	20	100
3	DCC	EVS8002T	Natural resources and their conservation	4-0-0	4	80	20	100
4	DCC	EVS8003T	Environmental pollution and monitoring	4-0-0	4	80	20	100
5	DCC-Lab	EVS8000P	Field Ecology Lab I	0-0-8	4	80	20	100
6	DCC-Lab	EVS8001P	Aquatic Ecology Lab	0-0-8	4	80	20	100
TOTAL					24	480	120	600

Semester II

S. no	COURSE TYPE	Course code	Title of course	L-T-P	NO. OF CREDITS	MAX. MARKS		TOTAL
						UNI. EXAMS	INT.ASSESSMENT	
1	DCC	EVS8004T	Biodiversity conservation	4-0-0	4	80	20	100
2	DCC	EVS8005T	Environmental chemistry	4-0-0	4	80	20	100
3	DCC	EVS8006T	Environmental hazards and Management	4-0-0	4	80	20	100
4	***GEC	EVS8100T	Environmental sustainability and management	4-0-0	4	80	20	100
5	DCC	EVS8002P	Field Ecology Lab II	0-0-8	4	80	20	100
6	DCC-Lab	EVS8003P	Soil Ecology Lab	0-0-8	4	80	20	100
TOTAL					24	480	120	600

M. Sc. CBCS CURRICULUM (PG403XX)
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Semester III

S. no	COURSE TYPE	Course code	Title of course	L-T-P	NO. OF CREDITS	MAX. MARKS		TOTAL
						UNI. EXAMS	INT.ASSESSMENT	
1	DCC	EVS8007T	Environmental engineering and management	4-0-0	4	80	20	100
2	DCC	EVS8008T	Environmental Laws and ethics	4-0-0	4	80	20	100
3	DSE	EVS8101T	Environmental toxicology	4-0-0	4	80	20	100
4	DSE	EVS8102T	Instrumental and environmental analysis	4-0-0	4	80	20	100
5	DCC-Lab	EVS8004P	Air Analysis Lab	0-0-8	4	80	20	100
6	DSE-Lab	EVS8100P	Instrumentation Lab	0-0-8	4	80	20	100
TOTAL					24	480	120	600

Semester IV

S. no	COURSE TYPE	Course code	Title of course	L-T-P	NO. OF CREDITS	MAX. MARKS		TOTAL
						UNI. EXAMS	INT.ASSESSMENT	
1	DCC	EVS8009T	Environmental and occupational health	4-0-0	4	80	20	100
2	DSE	EVS8103T	Environmental Planning & Biostatistics	4-0-0	4	80	20	100
3	DSE	EVS8104T	Environmental Impact Assessment	4-0-0	4	80	20	100
4	**DSE	EVS8105T	Environmental Training & skill	4-0-0	4	80	20	100
		EVS8106T	Restoration Ecology					
		EVS8107T	Environmental Microbiology And Biotechnology					
5	DCC-Lab	EVS8005P	Biostatics Lab	0-0-8	4	80	20	100
6	**DSE-Lab	EVS8101P	Environmental training	0-0-8	4	80	20	100
		EVS8102P	Restoration ecology Lab					
		EVS8103P	Biotechnology Lab					
TOTAL					24	480	120	600

** A minimum of 50% of the total admitted strength is required to run the options of papers as proposed in Semester IV, DSE & DSE-LAB papers in PG Programme.

***Intake in GEC paper will be decided considering availability of Resources and Faculty

M.Sc. (Two Years Degree Program under NEP scheme)

Subject-Environmental Sciences

First Semester

Code of the Course	EVS8000T
Title of the Course	BASIC CONCEPTS OF ECOLOGY AND ENVIRONMENT
Qualification Level of the Course	NHEQF Level 6.0
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in Environmental Sciences (DCC-1)
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, etc
Objectives of the course	To develop basic intuitiveness and critical approach about the basics of the subject
Learning outcomes	After completion , the student will be able to learn about basics of the subject, critical overview of the hierarchy in ecosystem and different types of environment

Syllabus

UNIT-I	Basic concept of ecology and Environment: components- Topographic, climatic, edaphic factors; Scope of ecology and its relations with other disciplines; Principles pertaining to ecosystem; ecosystem components: food chains, food web, ecological pyramids; Ecosystem energetics; energy budget and ecological efficiency; Processes of primary productivity, gross and net productivity; Homeostasis; Principles of limiting factors. (12 lectures)
UNIT -II	Biogeochemical cycles in Environment-concepts and significance, Carbon , Nitrogen, Phosphorus, oxygen, hydrological, Sulphur cycle; Autecology and synecology-Basic principles; Concept of population growth and survivorship; population characteristics and dynamics; population growth forms and concept of carrying capacity; Population regulation K and R selection, population changes. (12 lectures)
UNIT-III	Biotic community: concept and classification; community characteristics-Qualitative,Quantitative,phytosociologicalmethods: quadrats, Transects & IVI; Ecotone and continuum concept, Life forms and biological spectrum; Community coefficients; Ecological dominance and ecological niche; ecological succession, concept of climax and community stability; Biotic interactions, ecads; Ecological succession- types, causes and effects, climax community, succession models of ecosystem developments; Micro versus macro evolution. (12 lectures)

<p style="text-align: center;">UNIT-IV</p>	<p>Aquatic ecosystems: Lentic and lotic-Physicochemical characteristics of fresh water environment, Biotic communities of pond and lakes, thermal stratification of lakes, conservation and management of fresh water habitats; Physicochemical characteristics of Marine ecosystem, biotic communities of oceanic regions, coral reefs and mangroves; estuarine ecology; Concepts of wetland ecosystem, Ramser wetlands, wetlands with special reference to Rajasthan. (12 lectures)</p>
<p style="text-align: center;">UNIT-V</p>	<p>Terrestrial Environment: Physicochemical characteristics; Biomes of the world-Forest, Grassland, Desert and Tundra; Flora and Vegetation of India with special reference to Rajasthan; Endemism, Age and Area hypothesis, Dispersal dynamics; Role of ecotone in conservation and management of Biomes. (12 lectures)</p>
<p style="text-align: center;">Reference Books</p>	<ul style="list-style-type: none"> • FUNDAMNETAL OF ECOLOGY - E.P. ODEM • ECOLOGY AND ENVIRONMENT – PD SHARMA • ENVIRONMENTAL SCIENCE- SC SANTRA • SWIFT, HEAL- STUDIES IN ECOLOGY VOL-5 • ENVIRONMENTAL SCIENCE-DANIAL BOTKIN AND KELLER • ENVIRONMENTSAL SCIENCE- NEBEL WRIGHT • ECOLOGY- J.L. CHAPMAN
<p>-Suggested E-resources</p>	<ul style="list-style-type: none"> • https://www.classcentral.com/course/swayam-wildlife-ecology-20021 • https://www.classcentral.com/course/swayam-msd-012-ecosystem-and-natural-resources-32191

First Semester

Code of the Course	EVS8001T
Title of the Course	EARTH PROCESSES AND NATURAL CYCLES
Qualification Level of the Course	NHEQF Level 6.0
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in Environmental Sciences (DCC-2)
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. etc
Objectives of the course	To have a better understanding of relationship between environment, climate change, topography and meteorology
Learning outcomes	One can critically analyze the relationship between environment and climate change, role of geographical and geological aspects with changes across timeline
Syllabus	
UNIT-I	Evolution of atmosphere; Chemical composition and thermal stratification of present day atmosphere; Atmosphere and earth radiation balance, Latitudinal and seasonal variation of Insolation, temperature, pressure, wind belts, Humidity, cloud types & formation, precipitation; Circulation of earth's atmosphere and world precipitation pattern, precipitation to evaporation ratio; Hydrological cycle. (11 Lectures)
UNIT -II	Elements of climate: temperature, pressure, wind, Altitude, latitude, longitude, Horizontal and vertical distribution of air masses, Interrelationship between various elements of climate, properties of air masses, air circulation system in the tropics; Climate classification, World climate regimes; Climate types of India, Indian Monsoon; El Nino & La Nina; Climate control and distribution of plants and animals, Gaia hypothesis, Climate and biosphere-feedback mechanisms, Climate elements in crop production: temperature and crops, frost moisture, drought. (13 Lectures)
UNIT-III	Climate and habitable areas; climate and rural housing; climate and buildings; Micro climate and architectural design, modification of macro and micro climates with special reference to urban areas; Human body and heat balance; climate and human health, climate and race temperament, clothing insulation and clothing zones of the world. (11 Lectures)
UNIT-IV	Meteorology fundamentals– Pressure, temperature, wind, humidity, radiation, atmospheric stability adiabatic diagrams, turbulence and diffusion; Emission and absorption of terrestrial radiation, radiation windows, Net Radiation Budget-thermodynamic diagram; thermal inversion process; entropy and enthalpy, thermodynamics of dry and moist air and adiabatic processes; Applications of micrometeorology to vegetated surfaces, urban areas, human beings, animals; Application of meteorological principles to transport and diffusion of pollutants. (13 Lectures)
UNIT-V	Scavenging processes; Effects of meteorological parameters on pollutants and vice versa; Wind roses; Topographic effects; Pollution climatology; theories of climate change: forecasting climate, climate trends and climatic cycles; Preliminary concepts of climate change – global warming, sea level rise, ozone depletion, green house gases, smog, fog formation and dispersal.

	(12 Lectures)
Reference Books	<ul style="list-style-type: none"> • CLIMATOLOGY- SUBHASH MEHTA • SCIENCE OF WEATHER & ENVIRONMENT-ANNELTE BALGER • ATMOSPHERIC CHEMISTRY & PHYSICAL - JOHE H. SEINFELD • GENERAL CLIMATOLOGY- HOWARD J CRITCHFIELD • APPLIED CLIMATOLOGY- RUSSELL D. THOMPSON
Suggested E-resources	<ul style="list-style-type: none"> • https://www.classcentral.com/course/swayam-ecology-and-environment-14021 • 1519194090ENV_P8_Module-28_e-text.pdf • 1519277999ENV_P8_Module-24_e-text.pdf • 1513921840ENV_P8_Module-12_e-text.pdf

First Semester	
Code of the Course	EVS8002T
Title of the Course	NATURAL RESOURCES AND THEIR CONSERVATION
Qualification Level of the Course	NHEQF Level 6.0
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in Environmental Sciences (DCC-3)
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. etc
Learning outcomes	One can relate oneself with types and conservation of natural resources ,energy conservation, mineral, nuclear and forest resources
Syllabus	
UNIT-I	Natural Resources : Definition, Types & Classification, Concepts of Reserves & Resource availability, Environmental impacts of resource exploitation, Understanding Resource Ecology & life supporting capacity of Natural Resources- Economic models: Green Building concept & Green technology concept, Natural Resource Management. (11 Lectures)

UNIT -II	Definition of Energy-Types & units; Energy production and consumption pattern of world & India; Renewable and Non renewable Energy Resources, Principles of generation of Hydro electric power, Tidal power, Thermal energy conversion, wind and geothermal energy, Solar energy- Solar collectors, Photovoltaics, Solar ponds & Solar equipments- Heaters, driers, cookers; Harnessing Solar energy, solar electricity generation; Impact of large scale exploitation of solar, wind, hydro and ocean energy, Energy conservation policies. (13 Lectures)
UNIT-III	Non-renewable energy resources: Fossil fuel classification, composition and physico-chemical characteristics; energy content of petroleum and natural gas -formation, reserves, exploration/ Mining and uses of Coal; Environmental problems associated with mining, processing & transportation ; uses of Fossil fuels. (11 Lectures)
UNIT-IV	Bio energy: Biomass, Biogas, Refuse, Organic residues; Biomass fuel types- Solid, liquid and gaseous fuels, Availability of Biomass fuels in India; Biogas production and uses; Conversion processes– pyrolysis, charcoal production, compression, gasification and liquefaction; Anaerobic digestion; Energy from solid wastes- sources , types and energy production; Energy plantations- Carbohydrate crops, petro crops and Energy weeds. (12 Lectures)
UNIT-V	Mineral resources- origin, distribution and uses of economic minerals; Impact of mineral exploitation on environment, conservation of mineral resources; Mineral resources with special reference to Rajasthan; Forest Resource Management: distribution, wood Production , forest land-use changes in India, future demand of forests -carbon sequestrations; Nuclear energy resources-fission and fusion, nuclear fuel types, sustainable use. (13 Lectures)
Reference Books	<ul style="list-style-type: none"> • V. RAGHUPATHY – NATURAL RESOURCES • RESOURCES ECOLOGY- S. K. AGRAWAL • NATURAL RESOURCES- JERRY L. HOLECHEK CALE, FISHER • NATURAL RESOURCES CONSERVATION-OALI,NAVAID SHABIR QAZI
Suggested E-resources	<ul style="list-style-type: none"> • https://www.classcentral.com/course/swayam-ecology-and-environment-14021 • https://www.classcentral.com/course/edx-natural-resources-for-sustainable-development-8500

First Semester	
Code of the Course	EVS8003T
Title of the Course	ENVIRONMENTAL POLLUTION AND MONITORING
Qualification Level of the Course	NHEQF Level 6.0
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in Environmental Sciences (DCC-4)

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. etc
Learning outcomes	One can understand the types ,impacts, effects and preventive measures associated with different types of pollution
Syllabus	
UNIT-I	Environmental Pollution – concepts & Introduction, Global, regional and local prospective of environmental Pollution; Natural and anthropogenic sources of pollution; primary and secondary pollutants; Transport and diffusion of pollutants; Air pollution: source, effect of gaseous air pollutants on plants and animals, TSP and their effect on plants and animals; Principles of air monitoring; Air Pollution Tolerance Index, effect of meteorological & topographical factors on transport and dispersion of pollutants ; Lotka-voltera, prey-predator model, Gaussian plume model; Air Quality Standards, control of air pollution, Euro standards, Indoor and vehicular air pollution. (12 Lectures)
UNIT -II	Water pollution: types, Sources and consequences of water pollution; Principles of water quality monitoring, ecological and biochemical aspects of water pollution ,effects of domestic industrial and agricultural wastes on water bodies, physicochemical and bacteriological sampling and analysis of water quality; water quality standards; water pollutants and their control; Ganga Action Plan; Marine pollution; Thermal pollution. (12 Lectures)
UNIT-III	Radiation sources in environment- natural and man made; Sources and classification of Radioactive pollution, effect of radioactive pollution on biological system; Basic properties of noise, sound pressure, loudness and intensity levels, Sources and measurement of noise pollution, noise exposure levels and standards; noise pollution control and abatement measures; Noise survey - equipments and sampling. (12 Lectures)
UNIT-IV	Physicochemical and bacteriological sampling and analysis of soil; Sources of Soil pollution, Heavy metals sources and effects on biological systems; Pesticides sources and effect on biological systems, Detrimental effects of soil pollutants on soil micro biota, Ecological consequences and soil pollution control. (12 Lectures)
UNIT-V	Sources and characteristics of solid wastes, Environmental Problems associated with solid wastes disposal practices; Solid waste disposal and management, Biomonitoring of air, water and soil environment, concept of indicator species and their environmental significance, Introduction to pollutant- sensitive and resistant plants; environmental impacts of biomedical wastes: sources and waste minimization. (12 Lectures)
Reference Books	<ul style="list-style-type: none"> • ENVIRONMENTAL POLLUTION - TIMMY KATYAL • S.M. SHAJI – ENVIRONMENTAL POLLUTION • MARINE POLLUTION- A.P. DIWAN • NUCLEAR AND THERMAL POLLUTION- P.R. TRIVEDI GURDEEP RAJ
Suggested E-resources	<ul style="list-style-type: none"> • 1523277253Paper9_Module4_e-text.pdf • 1519193193paper10_Module3e-text.pdf

Environmental Sciences

Semester I PRACTICAL-I (DCC-LAB I)

Code of the Course	EVS8000P
Title of the Course	Field Ecology lab I
Credit of the course	04
Learning outcomes	To have basic knowledge of field experiments in form of quadrats, climatic parameters, graphs and working and operations of weather instruments

EXPERIMENT DETAILS

1. To determine minimum size of quadrat by species area curve method.
2. To study the vegetation by line transect method
3. To determine frequency, Density and Abundance of the given area
4. Find out the IVI of specified vegetational area
5. Find out the similarity and dissimilarity indices between disturbed and undisturbed grassland.
6. Determination of pattern (non randomness) in vegetation.
7. Estimation of total chlorophyll content of herbaceous vegetation on per square meter of land area basis
8. Study of biotic interactions and their ecological significance
9. Representation of climate data by
 - (1) Simple graph
 - (2) Hytherograph
 - (3) Rainfall variability graph
 - (4) Wind rose
 - (5) Combine bar and line graph
 - (6) Climograph
10. Observation of India weather maps.
11. Preparation of wind rose.
12. Construction, principle and working of weather instruments : Thermometer, Rain gauge, Anemometer, Barometer, Pedometer, Compass, lux meter ,hygrometer
13. To find out Index of Dominance in given area

	SPOTTING: : Thermometer, Rain gauge, Anemometer, Barometer, Pedometer, Compass, lux meter, hygrometer , <ul style="list-style-type: none"> • weather graph, temperature, wind rose, WEATHER GRAPHS, • Biotic interactions: proto cooperation, mutualism, parasitism, amensalism, symbiosis • Plant interactions : lichens ,root nodules, epiphytes, macrophytes, insectivorous plant
Reference Books	<ul style="list-style-type: none"> • Environmental Science Practical BY Pandey and Sharma
EOSE	<ul style="list-style-type: none"> • Internal Assessment - 20 marks • End semester exams- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)

Semester I PRACTICAL-II (DCC-LAB II)	
Code of the Course	EVS8001P
Title of the Course	Aquatic ecology Lab
Credit of the course	04
Learning outcomes	After learning , student will be well aware of physico –chemical analysis of water samples ,sampling instruments and aquatic environment
EXPERIMENT DETAILS	
	<ol style="list-style-type: none"> 1. Analysis of water samples: <ol style="list-style-type: none"> a) PHYSICAL ANALYSIS :Temperature, Turbidity, Conductivity, PH b) CHEMICAL ANALYSIS: Bicarbonates and Carbonates ,Total dissolved solids, Total suspended particulates, Salinity, Free CO₂, Alkalinity, Dissolved oxygen, COD, BOD, Primary productivity, Phosphate, Silicate, DOC & DOM , Total hardness, Nitrates, Chlorides 2. To study faecal coli forms in water sample by M.P.N. method 3. Qualitative and quantitative analysis of water samples for zooplanktons and phytoplanktons. 4. Preparation of field report of any case study carried out in any areas to assess the pollution status. 5. Temporary slide preparation of phyto and zooplanktons
	SPOTTING : <ul style="list-style-type: none"> • Sampling equipments : BOD Bottle, Sechhi disc, Plankton net, components of simple and compound microscope

	<ul style="list-style-type: none"> • Phytoplanktons : <i>microcystis, anabena, volvox, nostoc, occillatoria</i>, • Zooplanktons: moina, Cyclops, Daphnia, zoea larva, chironomus larva, nauplius larva, ticks, mites
Reference Books	<ul style="list-style-type: none"> • Environmental Science Practical BY Pandey and Sharma • Handbook of methods in Environmental studies by S. K. Maiti
EOSE	<ul style="list-style-type: none"> • Internal Assessment - 20 marks • End semester exams- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)

M.Sc. (Two Years Degree Program under NEP scheme)

Subject-Environmental Sciences

Second Semester

Code of the Course	EVS8004T
Title of the Course	BIODIVERSITY CONSERVATION
Qualification Level of the Course	NHEQF Level 6.0
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in Environmental Sciences (DCC-5)
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. etc
Objectives of the course	To develop basic intuitiveness and critical approach about the conservation strategies
Learning outcomes	After completion , the student will be able to learn about basics of the subject, critical overview of the biodiversity and its relation with environment

Syllabus

UNIT-I	Concepts and component of biodiversity- genetic, species and ecosystem biodiversity, evolution of organisms & distribution in space and time, levels of biodiversity, biodiversity indices, value of biodiversity, biodiversity trends, modern techniques of measurement and monitoring of biodiversity, bio prospecting, patent protection and bio piracy . (12 lectures)
UNIT -II	Major threats to biodiversity, IUCN threat categories, Red data book, threatened plants & animals of India; Endangered flora and fauna of India and Rajasthan, Mega diversity zones of India, Hot spot concept and hot spots of India, Biodiversity informatics, International efforts in biodiversity conservation. (12 lectures)
UNIT-III	Conservation of biodiversity- <i>In-situ</i> - Sanctuaries, biospheres Reserves, National Parks, Nature Reserves, Preservations plots; <i>Ex- situ</i> - Botanical gardens, Zoos, Aquaria, Home Garden & Herbarium, In vitro conservation: Germplasm & gene banks, tissue culture, pollen and spore bank, DNA bank; Wildlife reserves in India, Theory of reserve design, Restoration of biodiversity; Ecosystem people and traditional conservation mechanism; Importance of biodiversity in Ecotourism; endemic flora and fauna of tropics and India with special reference to Rajasthan (12 lectures)

UNIT-IV	National and International programmes for biodiversity conservation; Conservation of wildlife-significance and status of India, Wildlife reserves- Biosphere and nature reserves, Project tiger, sanctuaries and national parks in India; Impact of tourism on wildlife and problem in wildlife protection; Role of WWF,WCU,CITES, TRAFFIC . (12 lectures)
UNIT-V	Conservation of forests; Indian strategies and planning; Agroforestry, Social forestry; Management of forest products; Forests and tribals; Chipko Aandolan; Coral reefs, mangroves and estuarine biodiversity and their conservation; wetland conservation with special reference to Rajasthan; Biodiversity and agenda-21; Biodiversity conventions. (12 lectures)
Reference Books	<ul style="list-style-type: none"> • ECOLOGY AND ENVIRONMENT – P D SHARMA • SC SANTRA – ENVIRONMENTAL SCIENCE • GLOBAL BIODIVERSITY – P C TRIVEDI • TERRESTIAL ECOSYSTEMS – ASHOK MALIK • CONSERVING BIODIVERSITY OF RAJASTHAN – ASHOK VERMA • ECOLOGICAL BASIS OF AGROFORESTRY – DAIZY RAIN BATISH
Suggested E-resources	https://www.classcentral.com/course/swayam-ecology-and-environment-14021 https://onlinecourses.swyam2.ac.in/nou23_ge09/preview

Second Semester

Code of the Course	EVS8005T
Title of the Course	ENVIRONMENTAL CHEMISTRY
Qualification Level of the Course	NHEQF Level 6.0
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in Environmental Sciences (DCC-6)
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. etc
Objectives of the course	To have a better understanding of chemical changes occurring in environment and its relation with climate change
Learning outcomes	One can critically analyze natural chemistry occurring in ecosphere
Syllabus	
UNIT-I	Concept and Scope of Environmental Chemistry; segments of environment; Principles and cyclic pathways in the environments; Chemistry of Biologically Important Molecules: Chemistry of Water: Unusual physical properties, hydrogen bonding in biological systems, unusual solvent properties, changes in water properties by addition of solute. Protein structure and biological functions, enzymes, enzyme metabolism (12 lectures)
UNIT -II	Basic chemistry: Structure of atoms, their properties, their nuclear stabilities and their arrangement in the periodic table; fundamentals of chemical thermodynamics and solution formation-Normality, Molarity, Molality, Molecular weight, Equivalent weight, Mole concept; basic organic chemistry and biochemistry; Stoichiometry, Gibb's energy, Chemical potential, chemical equilibria, acid-base reactions; Solubility product, solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons. (12 lectures)
UNIT-III	Classification of elements, chemical speciation, Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter; Thermochemical and photochemical reactions in the atmosphere; Basic concepts of surface and interface chemistry: Absorption, adsorption, catalysis; collides, surfactants; carbonate system, radionuclides, radioactivity, decay of parent and growth of daughter nuclides & methods of radiometric dating; C14 dating system and procedure, stable isotopes – their fractionation and application to geo thermometry and paleo climates. (12 lectures)
UNIT-IV	First law of thermodynamics, enthalpy, adiabatic transformations; second law of thermodynamics, Carnot's cycle, entropy, Gibb's free energy, chemical potential, phase equilibria, Gibb's Donnan equilibrium; third law of thermodynamics, enzymes catalysis, Michaelis/ Menten equation; Concept, principle and utility of green chemistry, green reagents, green catalysts, industrial interest in green chemistry. (12 lectures)

UNIT-V	Oxygen and ozone chemistry, Chemistry of air pollutants, Photochemical Smog, Chemistry of water, concept of D.O., B.O.D., and C.O.D. Water treatment: Sedimentation, Coagulation, Filtration, tertiary and advanced treatment; Redox potential; Inorganic and organic components of soil; nitrogen pathways and NPK in soils. Bio transformation and bio magnification; Principles of photo chemistry- Photo chemical & photo sensitized reactions, energy transfer. (12 lectures)
Reference Books	<ul style="list-style-type: none"> • ENVIRONMENTAL CHEMISTRY – A.K. DE • ENVIRONMENTAL CHEMISTRY –PETER O NEIL • INTRODUCTION OF ATMOSPHERE CHEMISTRY –PETER V HOBLES • OZONE DEPLETION AND ENVIRONMENTAL IMPACTS – HS SHARMA • CHEMISTRY OF GREEN ENVIRONMENT – M M SHRIVASTAVA • BASIC CONCEPTS OF ENVIRONMENTAL CHEMISTRY – RES W CONNELL • ENVIRONMENTAL CHEMISTRY – SAMIR K BANERJI • ENVIRONMENTAL CHEMISTRY AND POLLUTION - MANTA V SACHDEVA
Suggested E-resources	<ul style="list-style-type: none"> • https://www.classcentral.com/course/swayam-environmental-chemistry-19858 • 1515046627paper16_module3_etext.pd • 1516345405paper16_module_06_etext.pdf • 1515393654paper16_module_08_etext.pdf • 1516343247paper16_module_15_etext.pdf

Second Semester	
Code of the Course	EVS8006T
Title of the Course	Environmental Hazards and Management
Qualification Level of the Course	NHEQF Level 6.0
Credit of the course	4
Type of the course	Discipline Centric Compulsory Course (DCC) in Environmental Sciences (DCC-7)
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. etc
Learning outcomes	To have a detailed concept of occurrence of natural hazards and disasters, their impact and preventive measures

Syllabus

UNIT-I	Introduction to hazards, classification and types: –Natural Hazards, Chemical hazards, Physical hazards, Biological hazards; Basics of hazard management and mitigation, natural Hazards –causes, continental drift, plate tectonics and sea floor’s spreading; hazard analysis, potential risk; Human perturbation and natural hazards – impact of deforestation, land use and developmental activities on natural hazards, Role of climate change; Man Made hazards - Dams & reservoirs, NPP; Desertification-causes, evaluation, Mitigation. (12 lectures)
UNIT -II	Natural Disasters: nature, causes and effect, Cyclone, tornadoes, floods, earthquakes, avalanches, Tsunami ,land slides, drought, fires, volcanism, Case study of disasters- community reaction to disasters, coping mechanism; disaster management- pre disaster phase, actual disaster phase, post disaster phase. (12 lectures)
UNIT-III	Disaster assistance-technological assistance, relief camps, food requirement, water needs, sanitation security, information administration, fire fighting training, Safety Measures – a general account, emergency rescue, disaster education- alternatives and new direction, Forecasting and warning systems (12 lectures)
UNIT-IV	Concept of disaster recovery- mitigation and preparedness, program planning and management, Vulnerability analysis, Training needs – Target Groups, emergency preparedness plan, occupational risk analysis survey and health evaluation, behavioral studies, Man-made disasters-occupational injury, Industrial Safety Management Techniques – Industrial Safety Standards, Industrial Accidents and Disasters - Frequency Rate, Prevention and Control; Dispersion of Radioactive material and release of Toxic and inflammable materials (12 lectures)
UNIT-V	Environmental hazards, protective measure while handling hazardous substance, hazardous waste disposal. Hospital waste handling and disposal, guidelines for their disposal, fire and explosion hazards, radiation hazards. Case studies related to hazardous waste accidents, simplified measures for their assessment. Various diseases related to handling of hazardous waste. Nasal cancer and other fatal diseases- their symptoms, prevention and control (12 lectures)
Reference Books	<ul style="list-style-type: none"> • ENVIRONMENTAL DISASTERS CAUSES, IMPACTS AND REMEDIES – MAHESH V JOSHI • DISASTERS – B K KHANNA • DISASTER MANAGEMENT – K K SINGH • DISASTERS – B K KHANNA • NATURAL DISASTER – ROBERT CONRADS • ENVIRONMENTAL POLLUTION HEALTH HAZARDS IN INDIA – R KUMAR
Suggested E-resources	<ul style="list-style-type: none"> • https://onlinecourses.swayam2.ac.in/nou21_bt06/preview • https://www.classcentral.com/course/swayam-natural-hazards-17703 • https://www.classcentral.com/course/swayam-plate-tectonics-184179

Second Semester

Code of the Course	EVS8100T
Title of the Course	Environmental Management and Sustainability
Qualification Level of the Course	NHEQF Level 6.0
Credit of the course	4
Type of the course	Generic Elective Course in Environmental Sciences (GEC-01)
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. etc
Objectives of the course	Student from any stream can opt for this course as it is related to certification and sustainable development
Learning outcomes	After the completion, one can understand the certification details and course related to sustainable development
Syllabus	
UNIT-I	Introduction, concept and scope of environmental management; Systems and approaches, International summits and treaties- Vienna convention, Montreal protocol, Kyoto protocol, Copenhagen convention; International Organization of Standardization (ISO): concept, significance and scope. (12 lectures)
UNIT -II	Sustainable development –concept & growth of idea, energy issues, Sustainable use of natural resources, Sustainability in industry and agriculture; relation of EIA with sustainable development; ecolabelling , eco marketing, eco restoration, green funding . (12 lectures)
UNIT-III	Basic concept of ISO 9001- scope, structure, guidelines, implementation and certification process. (12 lectures)
UNIT-IV	Basic concept of ISO 14000- scope, structure, guidelines, implementation and certification process; Environmental Audit, Environmental accounting; Environmental Management of Industrial pollution in relation to ISO 14000. (12 lectures)
UNIT-V	Management system OHSAS 18001 (occupational health & safety), ISO 26000 (social responsibility) AND ISO 50001 (energy management) - scope, structure, guidelines, implementation and certification process. (12 lectures)

Reference Books	<ul style="list-style-type: none"> • ENVIRONMENTAL MANAGEMENT – MICHAEL V RUSSO • ENVIRONMENTAL MANAGEMENT – N K UBEROI • ENVIRONMENTAL MANAGEMENT – R B SINGH • ENVIRONMENTAL MANAGEMENT - G N PANDEY • ENVIRONMENTAL CONCERN AND SUSTAINABLE DEVELOPMENT – SAKARAMA SOMAYA • GREEN TECHNOLOGIES FOR ENVIRONMENT MANAGEMENT AND SUSTAINABLE MANAGEMENT – RAJIV K SINHA
Suggested E-resources	<ul style="list-style-type: none"> • https://www.classcentral.com/course/swayam-environment-and-development-43590 • https://www.classcentral.com/course/sustainability-development-umich-93003 • https://www.classcentral.com/course/sustainable-development-goals-people-place-and-en-74851

Semester II PRACTICAL-I (DCC-LAB)	
Code of the Course	EVS8002P
Title of the Course	Field Ecology Lab II
Credit of the course	04
Learning outcomes	To have knowledge of field experiments, observations and statistical indexes
EXPERIMENT DETAILS	
	<ol style="list-style-type: none"> 1. Find out the percentage frequency values of grassland species using 1 x 1 size quadrat. Classify the species into frequency classes A to E and prepare the frequency diagram. Compare result with Raunkiers standard frequency diagram. 2. Determine the biomass of producers. 3. Find out the effect of various quadrat size 25 x 25, 50 x 50, 75 x 75 and 1 x 1 m on percentage frequency result on same grassland plot considered in exercise I 4. Find out the species diversity index in disturbed and protected vegetation area. 5. Find out the leaf area index of crop field. 6. Study of anatomical features of ecological adaptation in selected hydrophytes and xerophytes.

	<p>7. Study of climatic conditions obtained in open field and under the shade of trees for temperature, light intensity, wind velocity, R.H and comparison of ground vegetation of these areas.</p> <p>8. To determine the age of forest patch by DBH.</p> <p>9. To determine the vegetation by Point frame quadrat method.</p>
	<p>SPOTTING: :</p> <ul style="list-style-type: none"> • Xerophytes: <i>Nerium – Stem & leaf; Calotropis Stem; Capparis Stem; Pinus Needle; Opuntia; Euphorbia, Casurina</i> • Hydrophytes: <i>Ecchoria, Hydrilla, Trapa, Nymphaea, Chara, Potamogeton, Scirpus, Nelumbo</i> • Point frame • Xerophytic animals: <i>Phrynosoma, Draco</i> • Aquatic animals: <i>Exocoetel, Hyla, Gappi, Katla, Rohu, Gambusia</i>
Reference Books	<ul style="list-style-type: none"> • Environmental Science Practical BY Pandey and Sharma
EOSE	<ul style="list-style-type: none"> • Internal Assessment - 20 marks • End semester exams- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)

Semester II PRACTICAL-II (DCC-LAB)	
Code of the Course	EVS8003P
Title of the Course	Soil Ecology Lab
Credit of the course	04
Learning outcomes	After learning , student will be well aware of physico –chemical analysis of soil environment and related instruments
EXPERIMENT DETAILS	
	<p>1. Analysis of Soil samples</p> <p style="padding-left: 40px;">(1) Texture</p> <p style="padding-left: 40px;">(2) Moisture</p>

	<p>(3) pH</p> <p>(4) conductivity</p> <p>(5) Water holding capacity</p> <p>(6) Bulk density & porosity</p> <p>(7) Calcium carbonate</p> <p>(8) Sulphate</p> <p>(9) Carbonate and bicarbonate</p> <p>(10) Organic carbon & organic matter</p> <p>(11) Chlorides</p> <p>(12) Nitrates</p> <p>(13) Available phosphorus</p> <p>2. To compare the wilting coefficient of a xerophytic and mesophytic plant.</p> <p>3. Assessment of noise pollution in different zones of the city by Sound level meter.</p> <p>4. Study of soil for biotic components like bacteria, fungi & soil nematodes.</p>
	<p>SPOTTING :</p> <ul style="list-style-type: none"> • Instruments- Spectrophotometer, sound level meter, colorimeter, refrigerated centrifuge • Foot prints- of wild animals as available for demarcation of territory. • Soil fauna- Micro & macro fauna: Milipede, centipede, earthworm, nematodes, actinomycetes • Soil fungi and soil bacteria • Seives set for soil texture
Reference Books	<ul style="list-style-type: none"> • Environmental Science Practical BY Pandey and Sharma • Handbook of methods in Environmental studies by S. K. Maiti • Methods in Environmental analysis water soil and air - P.K.Gupta
EOSE	<ul style="list-style-type: none"> • Internal Assessment - 20 marks • End semester exams- 80 marks (Major I- 20; Minor I- 15; Minor II-10; Spotting- 20; Viva- 10 ; Record- 05 marks)