

**KAVAYITRI BAHINABAI CHAUDHARI
NORTH MAHARASHTRA UNIVERSITY, JALGAON**

॥अंतरी पेटवू ज्ञानज्योत॥



'A' Grade
NAAC Re-Accredited
(3rd Cycle)

SYLLABUS

for

**Master of Science (M. Sc.)
Environmental Science**

*Choice Based Credit System
(Outcome Based Curriculum)*

**DEPARTMENT OF ENVIRONMENTAL SCIENCE,
SCHOOL OF ENVIRONMENTAL AND EARTH SCIENCES
KAVAYITRI BAHINABAI CHAUDHARI
NORTH MAHARASHTRA UNIVERSITY,
JALGAON 425 001 (M.S.) INDIA**

(2019 - 2020)

**Summary of Distribution of Credits under CBCS Scheme
for
M.Sc. Environmental Science
at
School of Environmental and Earth Sciences
[at University Campus under Academic Flexibility w.e.f. 2019-20]**

Sr. No	Type of course	Sem I	Sem II	Sem III	Sem IV
01	Core	08	08	08	08
02	Skill based	04	04	-	-
03	School Elective	-	-	04	04
04	Practical	08	08	08	08
05	Audit	02	02	02	02
Total Credits		22	22	22	22

Subject Type	Core	Skill based	School Elective	Practical	Audit	Total Credits
Credits	32	08	08	32	08	88

Total Credits = 88

SCHOOL OF ENVIRONMENTAL AND EARTH SCIENCES
KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

**Syllabus under CBCS for M.Sc. (Environmental
 Science)**

Choice Based Credit System (Outcome Based Curriculum) with effect from 2019 -2020

Course credit scheme

Semester	(A) Core Courses			(B) Skill Based / Elective Course			(C) Audit Course (No Weightage in CGPA)			Total Credits (A+B+C)
	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (Practicals)	Total Credits	
I	4	8 + 8	16	1	4 + 0	4	1	2	2	22
II	4	8 + 8	16	1	4 + 0	4	1	2	2	22
III	4	8 + 8	16	1	4 + 0	4	1	2	2	22
IV	4	8 + 8	16	1	4 + 0	4	1	2	2	22
Total Credits	64			16			8			88

(T-Theory; P-Practical)

Structure of Curriculum

		First Year				Second Year				Total Credit Value
		Semester I		Semester II		Semester III		Semester IV		
		Credit	Course	Credit	Course	Credit	Course	Credit	Course	
(A)	Prerequisite and Core Courses									
	Theory	4	2	4	2	4	2	4	2	36
	Practical	4	2	4	2	4	2	4	2	24
(B)	Skill Based / Subject Elective Courses									
1	Theory /Practical	4	1	4	1	4	2 (Any 1)	4	2 (Any 1)	20
(C)	Audit Course (No weightage in CGPA calculations)									
1	Practicing Cleanliness	2	1							2
2	Personality & and Cultural Development Related Course			2	1					2
3	Technology Related + Value Added Course					2	1			2
4	Professional and Social + Value Added Course							2	1	2
	Total Credit Value	22	6	22	6	22	6	22	6	88

List of Audit Courses (Select any ONE course of Choice from Semester II; Semester III and Semester IV)

Semester I (Compulsory)		Semester II (Choose One)		Semester III (Choose One)		Semester IV(Choose One)	
		Personality and Cultural Development		Technology + Value Added Course		Professional and Social + Value Added Course	
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Code	Course Title
AC-101	Practicing Cleanliness	AC-201 (A)	Soft Skills	AC-301(A)	Computer Skills	AC-401(A)	Human Rights
		AC-201 (B)	Sport Activities	AC-301(B)	Cyber Security	AC-401 (B)	Current Affairs
		AC-201 (C)	Yoga	AC-301(C)	Rainwater Harvesting	AC-401(C)	Green Audit
		AC-201 (D)	Music	AC-301(D)	Ecotourism	AC-401(D)	Watershed Management

Semester-wise Course Structure of M.Sc. Environmental Science

SEMESTER I

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
EES-101	Core	Environmental Science: General Perspectives	04	--	04	40	--	60	--	100	--	04
EES-102	Core	Environment, Ecology and Ecosystem Dynamics	04	--	04	40	--	60	--	100	--	04
EES-103	Skill Based	Environmental Chemistry	04	--	04	40	--	60	--	100	--	04
EES-104	Practical	Practical Course on Environmental Chemistry	--	08	08	--	40	--	60	--	100	04
EES-105	Practical	Practical Course on Ecosystem	--	08	08	--	40	--	60	--	100	04
AC-101	Audit Course	Practicing Cleanliness		02	02		100	--	--	--	100	02

SEMESTER-II

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
EES-201	Skill Based	Air and Noise Pollution	04	--	04	40	--	60	--	100	--	04
EES-202	Core	Water Pollution	04	--	04	40	--	60	--	100	--	04
EES-203	Core	Solid Waste Pollution	04	--	04	40	--	60	--	100	--	04
EES-204	Practical	Practical Course on Air and Noise Pollution	--	08	08	--	40	--	60	--	100	04
EES-205	Practical	Practical Course on water and Terrestrial Pollution	--	08	08	--	40	--	60	--	100	04
AC-201(A)/201(B)/201(C)/201(D)	Audit Course	Choose one out of four (AC-201(A)/201(B)/201(C)/201(D)) (Personality and Cultural Development Related)		02	02		100	--	--	--	100	02

AC-201(A): Soft Skills

AC-201(B): Sports Activities

AC-201(C): Yoga

AC-201(D): Music

SEMESTER-III

Course Code	Course Type	Title of the Course	Contact hours/week			Distribution of Marks for Examination						Credits
			Th	Pr	Total	Internal		External		Total		
						Th	Pr	Th	Pr	Th	Pr	
EES-301	Core	Remote Sensing and Computer Application	04	--	04	40	--	60	--	100	--	04
EES-302	Core	Environmental Monitoring for EIA	04	--	04	40	--	60	--	100	--	04
EES-303	Elective	Choose One from EES-303 (A) and EES-303 (B)	04	--	04	40	--	60	--	100	--	04
EES-304	Practical	Practical Course on Environmental Monitoring	--	08	08	--	40	--	60	--	100	04
EES-305	Practical	Practical Course on Pollution Control and Waste Management	--	08	08	--	40	--	60	--	100	04
AC-301(A)/(B)/(C)/(D)	Audit Course	Choose one out of four (AC-301(A)/301(B)/301(C)/301(D)) (Technology + value added course)		02	02		100	--	--	--	100	02

List of elective courses to be offered in Semester-III:

EES-303 (A): Pollution Control and Waste Management

EES-303 (B): Advanced Pollution Control Technologies

List of Audit courses to be offered in Semester-III:

AC-301(A): Computer Skills (T)

AC-301(C): Rainwater Harvesting

AC-301(B): Cyber Security

AC-301(D): Ecotourism

SEMESTER-IV

Course Code	Course Type	Title of the Course	Contact hours/week			Distribution of Marks for Examination						Credits
			Th	Pr	Total	Internal		External		Total		
						Th	Pr	Th	Pr	Th	Pr	
EES- 401	Core	Industrial Safety, Hygiene and Toxicology	04	--	04	40	--	60	--	100	--	04
EES- 402	Elective	Choose One from EES-402 (A) and EES-402 (B)	04	--	04	40	--	60	--	100	--	04
EES- 403	Core	Nature Resources and Biodiversity Conservation	04	--	04	40	--	60	--	100	--	04
EES- 404	Practical	Practical Course on Industrial Visits	--	08	08	--	40	--	60	--	100	04
EES- 405	Practical	Practical Course on Research Dissertation	--	08	08	--	40	--	60	--	100	04
AC-401(A)/(B)/(C)/(D)	Audit Course	Choose one out of four (AC-401(A)/401(B)/401(C)/401(D)) (Professional and Social + value added course)		02	02		100	--	--	--	100	02

List of elective courses to be offered in Semester-IV:

EES-402 (A): Environmental Policies and Legislation

EES-402 (B): Safety Legislations and Management

List of Audit courses to be offered in Semester-IV:

AC-401(A): Human Rights

AC-401(B): Current Affairs

AC-401(C): Green Audit

AC-401(D): Watershed Management

Program at a Glance

- ❖ Name of the program (Degree) : M. Sc. (Environmental Science)
- ❖ Faculty : Science and Technology
- ❖ Duration of the Program : Two years (four semesters)
- ❖ Medium of Instruction and Examination : English
- ❖ Exam Pattern : 60:40 (60 marks University exam and 40 marks continuous internal departmental exam/assessment)
- ❖ Passing standards : 40% in each exam separately (separate head of passing)
- ❖ Evaluation mode : CGPA
- ❖ Total Credits of the program : 88 (64 core credits including 4 credits of project/dissertation, 08 skill enhancement credits, 08 subject elective credits and 08 audit credits)

Eligibility

Bachelor's degree in Science and Agriculture from any recognized University with at least 50 % marks.

Duration

The duration of M.Sc. (Environmental Science) degree program shall consist of two academic years divided in to four semesters. Each Semester consist of 90 working days. Each theory course will be completed in 60 hours and practical course in 96 hours.

Medium of instruction

The medium of instruction and examination for each course shall be English.

Credit to contact hour

One credit is equivalent to 15 periods of 60 minutes each for theory course lecture.

Attendance

The student enrolled must have 75% attendance in each course to appear for term end examinations, otherwise the candidate may not be allowed to appear for term end examination as per the Rules.

Examination

Each theory and practical course will be of 100 marks comprising of 40 marks for internal (20 marks of 2 internal examinations) and 60 marks external examination. Separate head of passing in Internal and External examination is mandatory. In case of failure in internal examination of

particular course, student will have to appear for the same in next semester as per the schedule of the examination. In case a student fails in particular course in a semester and the same course(s) are revised/removed from curriculum in due course, the student will have to appear as per new curriculum and or pattern in subsequent semester at his own responsibility.

Program Objectives for M.Sc. Program:

1. To produce skilled experts with a background of Environmental Science employable for positions in the fields like education, industry and government and non-government organizations.
2. To impart knowledge on human environment interaction and provide knowledge on issues related to development and environment.
3. To impart technical/analytical methodologies for environmental analysis.
4. To provide technical methodologies (EIA/EA/Safety management) for sustainable development
5. To prepare our graduates to become effective scientific communicators/collaborators in multidisciplinary teams providing technical leadership to engage with the challenging environmental problems of local, national, and global nature.

Program Outcomes (PO) for M.Sc. Program:

Upon successful completion of the M.Sc. program, student will be able to:

PO No.	PO	Cognitive level
PO1	Students will be able to demonstrate, understand and apply the basic concepts of ecosystem and other sciences suitably in environmental science.	2
PO2	Students can analyze the relationship between natural resources, animals, plants as well as human being.	4
PO3	Students must understand the procedures of Environmental Impact Assessment / Environmental Audit / Industrial Safety.	2
PO4	Students must investigate the legal procedure/Compliances required towards sustainable industrial development.	4
PO5	It is expected that the students will realize the impact of professional engineering solutions in societal and environmental contexts for sustainable development.	2

Program Specific Objectives

1. To produce skilled experts with applied aspects of Environmental Science employable for positions in the field of education, industry, government and non-government organizations.
2. To impart knowledge on advances and challenges in Environmental Sciences.
3. To impart technical/analytical methodologies for qualitative and quantitative evaluation of water, air, soil and biodiversity.
4. To provide knowledge on technologies for treatment of water, wastewater and control of air pollution.
5. To prepare our graduates to become effective scientific communicators/collaborators in multidisciplinary teams providing technical leadership to engage with the challenging geological problems of local, national, and global nature.

Program Specific Outcomes

Students who graduate with a Master of Science in Environmental Science will:

PSO No.	Program Specific Outcomes	Cognitive level
PSO1	Understand the basic concepts of Environments and its components along with their interactions through study of Ecology, Biodiversity, Environmental Chemistry, and Environmental Microbiology	2
PSO2	Understand the different types of Pollutions and their sources and interactions through study of Climate and Air Pollution Studies, Hazardous Waste & Environmental Toxicology and Soil Pollution and different laws about pollution.	2
PSO3	Analyze and determine pollution using Environmental Analytical Techniques, Biostatistics and Computational Techniques.	4
PSO4	Understand different technologies like biotechnology, advances in water and wastewater treatment technology to find the solutions and their applications in abatement of environmental pollution.	2
PSO5	Apply advance tools like Remote Sensing & Geographical Information Systems for the management of Environment, Energy resources, solid wastes, biodiversity conservation.	4
PSO6	Prepare the industrial safety and management plan.	6

M. Sc. (Environmental Science)

SYLLABUS

Distribution of Course papers for M. Sc. Part I Environmental Science

Subject Code	Title of the Paper		Duration (Hrs./Wk)	Max. Mark	Exam. Time (Hrs.)
M.Sc. Part I (Environmental Science)					
Semester I : Theory Courses					
EES- 101	Environmental Science: General Perspectives	Core course	04	100	03
EES- 102	Environment, Ecology and Ecosystem Dynamics	Core course	04	100	03
EES- 103	Environmental Chemistry	Skill Based	04	100	03
Semester I : Practical Courses					
EES- 104	Practical Course on Environmental Chemistry	Core course	04+04	100	06
EES- 105	Practical Course on Ecosystem	Core course	04+04	100	06
AC-101	Practicing Cleanliness	Audit Course	02	100	
Semester II : Theory Courses					
EES-201	Air and Noise Pollution	Core course	04	100	03
EES-202	Water Pollution	Core course	04	100	03
EES-203	Solid Waste Pollution	Skill Based	04	100	03
Semester II : Practical Courses					
EES-204	Practical Course on Air and Noise Pollution	Core course	04+04	100	06
EES-205	Practical Course on water and Terrestrial Pollution	Core course	04+04	100	06
AC-201A/B/C/D	Choose one out of Four (AC-201A/ AC-201B/ AC-201C/ AC-201D) from Personality and Cultural Development (Audit Course)	Audit Course	02	100	

**M. Sc. PART-I (ENVIRONMENTAL SCIENCE)
(SEMESTER – I)**

CORE COURSE		
EES-101: ENVIRONMENTAL SCIENCE: GENERAL PERSPECTIVES		
	<p>Course objectives:</p> <ol style="list-style-type: none"> To demonstrate an ability to integrate the many disciplines and understand natural and built environments shape with environmental concerns. Develop skills of analysis and communication, bearing in mind disciplinary traditions and diverse publics to recognize environmental problems. Establish an integrative approach to environmental issues with a focus on sustainability. 	
Unit 1	Basic issues in environmental sciences: Definition, principles and scope of environmental science, sustainability and carrying capacity. Environmental Problems of India: over population, food, health, energy and environmental security, negative side of green revolution.	08 L
Unit 2	Earth as a system: Environmental unity, earth and life, earth as an eco-system, changes and equilibrium in systems, mass and energy transfer across various interfaces, material balance, first and second law of thermodynamics, heat transfer process.	10 L
Unit 3	Environmental geology: Definition, principles and scope. Natural and manmade hazards: lithosphere, hydrosphere, atmospheric hazards and manmade hazards.	12 L
Unit 4	Urban environment and agriculture: City as a system, concept of smart city. Sustaining living resources: Sources of food. Agriculture: Effects of agriculture on environment, integrated pest management and sustainable agriculture.	10 L
Unit 5	Energy and environment: Alternative energy sources: Geothermal energy, renewable energy sources, Solar energy, Hydrogen, Water power, Wind power, Energy form biomass. Nuclear energy and environment. Integrated energy management.	10 L
Unit 6	Minerals and environment: Importance of minerals in environment, agriculture, industry, and life. Resources and reserves. Environmental impact of mineral development, cost benefit analysis.	10 L
<p>Suggested readings:</p> <ol style="list-style-type: none"> Environmental Sciences, Daniel Botkin and Edward Keller, John Wiley and Sons, New York (1997). Environmental Sciences, S. C. Santra, New Central Book Agency (P) Ltd. Kolkata (2005) Environmental Science, Eldon D. Enger and Bradley F. Smith, WCB Publishers, Boston (1995). Forests in India, Dr. A. K. Jain Vorha Publication, Allahabad (1989). Advances of Environmental Science and Technology, Nileema Rajvaidya APH Publishing House, Delhi (1989) R.K. Dixit, Environment, Forest Ecology and Man, Rastogi publication, New Delhi. (1997) 		

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 101.1	The Environmental Science minor supplements other majors to facilitate students understanding of complex environmental issues from a problem-oriented, interdisciplinary perspective.	2
C 101.2	Appreciate key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental general perspectives.	4
C 101.3	Emphasis about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.	5

CORE COURSE

EES-102: ENVIRONMENT, ECOLOGY AND ECOSYSTEM DYNAMICS		
	Course Objectives: 1. To learn the phenomenon of ecosystem and concept, principles of ecology. 2. Assessment of quantitative and qualitative characteristics applicable to ecological research through field exercises for ecological balance and conservation of biodiversity. 3. Understanding of conceptual treatment and characteristics of population ecology and community ecology.	
Unit 1	Introduction to ecology: Scope, basic concepts in ecology, Approaches to ecology, its main subdivisions and developmental facets, autecology, synecology and applied ecology, environmental complexes, Interaction of ecological factors.	10 L
Unit 2	Abiotic factors: Light, temperature, precipitation (rainfall), humidity, wind factor and fire factor. (i) Topographic factor (Physiographic): height and direction of mountain steepness of slopes and exposure of slopes. (ii) Edaphic factor: Importance, formation of soil, factors affecting on soil formation, soil erosion and soil conservation. (iii) Ecological Adaptations: Ecological groups of plants and ecological adaptations in Hydrophytes, Mesophytes, Xerophytes, Halophytes.	12 L
Unit 3	Biotic factors: Ecosystem - concept of ecosystem, structure and functions of ecosystem, pond, grassland, forest, desert, cropland ecosystems. Primary and secondary productivity of ecosystems. Food chains and food web, ecological pyramids of energy, biomass and numbers. Biogeochemical cycles: carbon, nitrogen, sulfur and phosphorous at the biosphere levels.	12 L
Unit 4	Population and Community ecology: Population characteristics, population growth curves, biotic potential, natality, mortality, age structure. community ecology: Evaluation, origin, structure and development of community, species diversities in communities, ecotones and ecological niche.	10 L
Unit 5	Ecological succession: Introduction, general process of succession, causes of succession, types and trends of succession, climax concept in succession.	08 L
Unit 6	Ecosystem modeling and biodiversity: Scope, types and development of environmental modeling. Concept of biodiversity, types of biodiversity, major biomes distribution.	08 L
Suggested readings: 1. K.C. Agrawal, Environmental Biology, Agro-Botanical publishers, Bikaner. (1993) 2. E. P. Odum, Fundamentals of Ecology Revised edition (1995) 3. P. S. Verma, V. K. Agrawal, Environmental Ecology S. Chand & Co., New Delhi.(1998) 4. P. D. Sharma, Ecology & Environment, Rastogi Publications, Meerat.(VII Edi.2000) 5. Eldon D. Enger and Bradley F. Smith, Environmental Sciences, WBC publishers, Boston. (1995) 6. Daniel Botkin and Edward Keller, Environmental Sciences, John wiley & Sons, New York. (1997) 7. R.K. Dixit, Environment, Forest Ecology and Man, Rastogi publication, New Delhi. (1997)		

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 102.1	On completion of this course students will be able to describe the scientific inquiry in the field of modern ecology, explain the main limitations on patterns of productivity, energy flow through natural food chain and food webs, ecosystems dynamics and patterns in populations and communities.	2
C 102.2	It is also expected that student will be able to pertain basic ecological sampling techniques in different ecosystems and be proficient in summarizing and reporting data.	3

SKILL BASED COURSE

EES-103: ENVIRONMENTAL CHEMISTRY

	<p>Course Objectives:</p> <ol style="list-style-type: none"> To impart knowledge of chemistry of elements and compounds in air, water and soil environment. To provide knowledge of chemical reactions involved in generation and modification of chemical pollutants. To provide knowledge about interactions among various components of environment and mechanisms of environmental phenomena. 	
Unit 1	Fundamentals of environmental chemistry: Concept and scope of environmental chemistry, stoichiometry, Gibb's energy, redox potential, chemical potential, chemical equilibria, acid-base reaction, solubility products, solubility of gases in water, definition of environmental term.	10 L
Unit 2	Atmospheric chemistry: Atmosphere- composition, structure, heat balance, chemical composition of air (classification of elements, chemical speciation, particles, ions and radicals in atmosphere), chemical processes for formation of inorganic and organic particulate matter, thermo chemical and photochemical reactions in the atmosphere, oxygen and ozone chemistry.	10 L
Unit 3	Soil chemistry: Lithosphere: formation of the earth, zonal structure of the earth and its composition, composition of the earth as a whole, differentiation of elements. Soil and agricultural, nature and composition of soil, acid-base and ion-exchange reaction in soil, macronutrients in soil, NPK in soil, micronutrients in soil.	10 L
Unit 4	Chemistry of water and aquatic system: Hydrosphere- characteristic, characteristic and structure of the ocean, snow and ice, freshwater system. Properties of water and their significance, characteristic of water bodies, alkalinity, acidity, calcium and other metals in water, sedimentation, coagulation, organic pollutants in sewage, soaps, oil and detergents, pesticides in water, their classification, radio-nuclide in water.	10 L
Unit 5	Analytical environmental data: Basic concept and definition, true results, error, types of error, accuracy, precision and standard deviation	08 L
Unit 6	Instrumental techniques in environmental analysis (Principle, Instrumentation, Merits-demerits and Applications of techniques): Neutron activation analysis, isotope dilution analysis, colorimetry, spectrophotometry, atomic absorption spectrophotometry, flame photometry, gas chromatography, high performance liquid chromatography, ion exchange chromatography and polarography	12 L

Suggested readings:

- A. K. De Environmental Chemistry, Wiley Eastern Ltd, New Delhi (2001).
- G. S. Sodhi, Fundamental concepts of Environmental Chemistry, Narosa Publishing House, New Delhi (2002).
- F.W. Field and P.J. Haines, Environmental Analytical Chemistry, Blackwell Science Ltd. USA (2000).
- Physicochemical examination of water, sewage and industrial effluent, Pragati prakashan, Meerut, (1996).
- Standard Methods for the examination of Water and Wastewater, 19th Edn, American Public Health Association (1995).

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 103.1	The students will understand the chemical properties of materials occurring in the environment, phenomenon in the environment and apply knowledge to environmental sampling and processes	2
C 103.2	To study interactions and differentiate various components of environment and to evaluate the impact of human activities on the environment.	4

CORE COURSE**EES 104: PRACTICAL COURSE ON ENVIRONMENTAL CHEMISTRY****Course Objectives:**

1. To impart training for monitoring of basic ecological parameters.
2. To familiarize the student with the general instrumentation used for environmental monitoring.

1	Studies on the concept of morality, normality and buffers solutions.
2	Calibration of pH and conductivity meter and their applications.
3	Studies on the principles, component & working operation of colorimeter and spectrophotometer.
4	Study on the principle, component & working operation of flame photometer and its applications.
5	Determination the turbidity of given sample by using Turbidity meter.
6	Study on principle and working operation of Potentiometer and its application in estimation of chloride in water sample.
7	Analysis of total dissolved & suspended solids from water.
8	Study on physical characteristics of soil.
9	Determination of organic matter by Walkley and Black method from soil.
10	Estimation of dissolved oxygen by Winkler's method.
11	Determination of bicarbonate and carbonate alkalinity of water.
12	Determination of temporary & permanent hardness of water.
13	Demonstration of HPLC for pesticides analysis.
14	Demonstration of Atomic Absorption Spectroscopy for heavy metal analysis.
15	Determination of a) λ max of the solution of KMnO_4 b) Verify Beer's law and find out the concentration of unknown solution by spectrophotometer.
16	Determination of the concentration of iron in water sample by spectrophotometric method.

Suggested readings:

1. J. E. Fergusson, Inorganic Chemistry of Earth
2. Raiswell, Environmental Chemistry
3. S. E. Manahan, Environmental Chemistry
4. R. A. Home, The Chemistry of Our Environment:
5. Henry D. Forth, Fundamentals of Soil Sciences
6. T. D. Biswas and S. K. Mukherjee, A. Text-Book of Soil Sciences

Course Outcomes (COs):

After completing this course graduate should able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 104.1	Monitor and analyse the basic parameters of soil and water	4
C 104.2	Will able to handle the common instruments available in environmental laboratory to evaluate environmental quality	6

CORE COURSE	
EES 105: PRACTICAL COURSE ON ECO-SYSTEM	
	Course Objectives: 1. To impart training in ecological monitoring. 2. To familiarize the students with biogeochemical cycles in the environment. 3. To impart knowledge of analytical procedures for industrial waste analysis.
1	Microscopy- a) Use of compound microscopy b) Calibration of microscopy
2	Staining techniques - a) Monochrome staining b) Gram staining
3	Slide culture techniques for examination of fungi / actinomycetes
4	To study the biotic components of a pond ecosystem
5	To compare the biomass and net primary productivity of ungrazed and grazed grassland.
6	To determine the minimum size of the quadrat by 'Species Area Curve' method.
7	To determine the minimum number of quadrates to be laid down in the field under study.
8	Estimation of total viable counts in water and soil samples.
9	Preparation and sterilization of microbial media.
10	Estimation phosphatic fertilizers by colorimetric analysis.
11	Estimation of sucrose from sugar industry effluent.
12	Estimation of protein from leather industry effluent.
13	Vegetation studies by line and belt transact method & their analysis.
14	Assessment of phyto and zooplankton in fresh water bodies.
15	Isolation and enumeration of soil bacteria and fungi.
16	Determination of primary productivity by light and dark bottle method.
	Suggested readings: 1. E. P. Odum, Fundamentals of Ecology 2. H. D. Kumar, Modern concepts in Ecology 3. Henry D. Forth, Fundamentals of Soil Sciences 4. T. D. Biswas and S. K. Mukherjee, A. Text-Book of Soil Sciences 5. Standard Methods of Biochemical Analysis, Kalyani Publishers, Delhi.

Course Outcomes (COs):

After completing this course graduate should able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 105.1	Understand ecosystem services and dynamics	2
C 105.2	Students will able to apply acquired knowledge to monitor ecological parameters using microbiological techniques.	3

M.Sc. Part I Semester I (Environmental Science): Audit Courses

AC-101: Practicing Cleanliness (Compulsory; Campus-level Audit Course; Practical; 2 Credits)	
Course Objectives (CObs): <ul style="list-style-type: none">To make students aware of Clean India Mission and inculcate cleanliness practices among them.	
	<ul style="list-style-type: none">Awareness program on<ul style="list-style-type: none">Swachh Bharat Abhiyan (Clean India Mission)Clean Campus MissionRole of youth in Clean India MissionCleaning activities inside and surroundings of Department buildings.Tree plantation and further care of planted treesWaste (Liquid/Solid/e-waste) Management, Japanese 5-S practicesPlanning and execution of collection of Garbage from different sections of University campusRole of youth in power saving, pollution control, control of global warming, preservation of ground water and many more issues of national importance.Cleanest School/Department and Cleanest Hostel contestsPainting and Essay writing competitions

Course Outcomes (COts):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC101.1	Identify need at of cleanliness at home/office and other public places.	2
AC101.2	Plan and observe cleanliness programs at home and other places.	4
AC101.3	Practice Japanese 5-S practices in regular life.	3

**M. Sc. PART I (ENVIRONMENTAL SCIENCE)
(SEMESTER-II)**

SKILL BASED COURSE		
EES-201: AIR AND NOISE POLLUTION		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> To acquire skills on air and noise monitoring from ambient and indoor environment. To study the micrometeorological impacts on the air pollution dispersion. To study the atmospheric reactions and formation of secondary and tertiary air pollutants. 	
Unit 1	<p>Air pollution: Definition, natural and man-made sources of air pollution, stationary and mobile sources, primary and secondary pollutants, global background concentrations, macro and micro methodological influences, transport and diffusion of pollutants, emission and ambient standards, local regional and global criteria for effects of air pollution, vehicular pollution and urban air quality.</p>	10 L
Unit 2	<p>Air pollutants: Sulfur oxides (SO_x); nitrogen oxides (NO_x), carbon monoxide, total suspended particulate matter, respirable particulates, photo-chemical oxidants, specific pollutants (Hydrogen sulphide, particulate fluoride, formaldehyde and volatile organic compounds), chemical composition of SPM and RSP for toxic trace metals like Pb, Cd, Hg, Ni and Cr. Importance of inorganic ionic composition like SO₄, Cl, NH₄, Na, K, Ca, Mg and organic acids in aerosols and precipitations, photochemical smog, peroxy acyl nitrates (PAN), benzo-\square-pyrene (BAP) formations, atmospheric sinks.</p>	12 L
Unit 3	<p>Global air pollution problems: Greenhouse effect (Greenhouse gases: CO₂, CH₄, N₂O, CFC's, water vapor concentration, alternatives for CFC's, fire extinguishers), global warming and climate change, ozone layer depletion (ozone depleting processes, ozone hole, environmental effects and strategies for ozone layer protection), acid rain.</p>	10 L
Unit 4	<p>Effects of air pollution and air monitoring instruments: Human health, plants, animals and microbes, archeological monuments and aesthetics, Orsat apparatus, high volume air sampler and source monitors.</p>	08 L
Unit 5	<p>Air pollution meteorology: Wind speed, direction and their vertical profiles, turbulence (mechanical and thermal), atmospheric stability characteristics and classes, Plume behavior, effects of micrometeorology on point source emission, wind-valley effects, land/sea breeze-effects, heat island effect, mixing height-boundary layer definition, temperature inversions, factors affecting on dispersion of air pollutants, micrometeorological instruments.</p>	10 L
Unit 6	<p>Noise pollution: Properties of sound waves, sound pressure and sound level measures, sound level meters, definition of noise, industrial community noise factors, effects of noise on human beings, hearing mechanism, audiometric tests, damage - risk criteria, effects on human performance, noise rating systems, noise standards and guidelines, permissible noise levels for occupational exposures, noise pollution control and abatement measures.</p>	10 L
<p>Suggested readings:</p> <ol style="list-style-type: none"> Magill, Holden and Ackdey, Air Pollution Hand Book, Mc-Graw Hill, New Delhi (1998) R. K. Trivedi & P. K. Goel, An Introduction to Air Pollution, Techno Science Publications, Jaipur (1995) C. S. Rao, Environmental Pollution Control Engineering, New Age International Publication New Delhi (2001) A. Sharma & A. Roychaudhari, The Deadly Story of Vehicular Pollution in India, CSE New Delhi (1996) Wahi S. K., Agnihotri A. K., and Sharma J.S., Environmental Management, Willey Eastern Ltd., New Delhi. (1992) G. N. Pandey, and G.C. Carney, Master Gillbert M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi (2000). E. Robart Alley and Associates, Air Pollution Control Hand-book, Mc-Graw Hill, New Delhi (1998) 		

Course Outcomes (COs):

After completing this course graduate should able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 201.1	The students will be able to decide and establish monitoring locations for air and noise pollution	5
C 201.2	Develop ability to understand the patterns of air pollution dispersion with respect to micrometeorological changes.	3
C 201.3	Acquire ability for air/ noise sampling and analysis. They Understand about climate change and atmospheric reactions.	4

CORE COURSE

EES-202: WATER POLLUTION

	<p>Course Objectives:</p> <ol style="list-style-type: none"> To learn significance of water quality and its importance for living being including human. To learn the causes of water pollution. To demonstrate impacts of water pollution. To describe measures to. control water pollution 	
Unit 1	<p>Characteristics of water and wastewater: Physical, chemical, and biological characteristics of water and wastewater, physiochemical and bacteriological sampling and analysis of water quality, quality standards, (BIS, WHO, CPCB and US Environmental Protection Agency), water quality indices: definition, types, applications and significance, water quality for industrial and bathing purpose, prevention and control of water pollution, sewage treatment plant.</p>	12 L
Unit 2	<p>Sources of water pollution: Point and non-point sources of water pollution: urban, industrial, agricultural and natural waters, interaction in aquatic system, nature of sources- stationary, intermittent, continuous and mobile, sources of marine pollution, criteria for disposal of pollutants in marine ecosystem, coastal management.</p>	08 L
Unit 3	<p>Pollution potential of industrial effluents (Process, sources and characteristics): Effluent characteristics- (temperature, exit velocity, concentration and volume). Nuclear/thermal power stations, agriculture, sugar, food processing, chemical, tanneries, pulp and paper, oil and petroleum, textile and electroplating industries.</p>	10 L
Unit 4	<p>Water resources and environment: Phytoplankton, zooplankton and macrophytes in aquatic ecosystem, global water balance, ice sheets and fluctuations of sea levels, origin and composition of sea water, types of water: surface, ground water, brackish and marine water, human use of surface and ground water, exploration of ground water, ground water table, aquifers, design, construction and maintenance of wells and infiltration galleries.</p>	12 L
Unit 5	<p>Consequences of water pollution: Biological uptake of pollutants and their effects on land, vegetation, animals and human health, bio-deterioration, bioaccumulation, bio- magnification and eutrophication, infectious microbial agents in water system and their consequences on human health.</p>	10 L
Unit 6	<p>Specific pollutants in aquatic system: Specific pollutants and their speciation, behavior, toxicity and detoxification of pollutants. (Heavy metals, pesticides, fertilizers and radioactive materials).</p>	08 L

Suggested readings:

- Gerard Kiely, Environmental Engineering Vol. I, II, & III Liptak, Tata McGraw Hill, New Delhi. (1998)
- A.K. De, Environmental Chemistry. 2nd edn., 1990, Wiley Eastern Ltd., New Delhi.
- Nancy J. Sell, Industrial Pollution Control, John Willey and Sons, Inc., New York (1992)
- S.S. Dara, A Text Book of Environmental Chemistry and Pollution Control, S. Chand, and Co. Ltd., New Delhi. (1995)
- P. K. Goal and K. P. Sharma, Environmental Guidelines and Standards in India, Techno science Pub. Jaipur, India (1996)
- G. R. Pathade, and G. K. Goal, Environmental Pollution and Management of Waste Water by Microbial Techniques, A. B.D. Pub. Jaipur India (2001)
- S. N. Jogdand, Environmental Biotechnology (Industrial Pollution Management) Himalaya Pub. House Delhi.

Course Outcomes (COs):

After completing this course graduate should able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 202.1	The students will be able to describe the physical and chemical compositions of water and wastewater and elucidate how and why these compositions fluctuate, main sources of water pollution, the main types of pollutant and how each type may be controlled.	2
C 202.2	They will be able to Identify the criteria for drinking water acceptability in the India/ world and outline the processes used to treat water for a public water supply and understand how sewage may be treated before discharge to the environment.	2

CORE COURSE		
EES-203: SOLID WASTE POLLUTION		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> To impart knowledge on identification and classification solid wastes generated in an ecosystem. To impart knowledge of physical and chemical analysis of municipal solid wastes and its application in waste management strategy. To impart knowledge on collection, transportation and management of municipal solid wastes by physical, chemical, thermal and biological methods. To impart knowledge about classification, storage, transportation and management of hazardous wastes. 	
Unit 1	Composition of solid wastes: Nature & composition of solid wastes- Ashes, slags, agro residues, industrial wastes, sewage treatment sludges, grits, debris, dirt, masonry, garbage, rubbish, trash, dead animals, abandoned vehicles, bulky wastes, special wastes or hazardous wastes.	10 L
Unit 2	Sources of solid waste: Classification of solid wastes- Urban and rural, agricultural and industrial, construction and demolition, Hazardous or special wastes- Chemical wastes, Biomedical wastes, Nuclear wastes, Explosive wastes.	10 L
Unit 3	Collection, transportation and characterization of solid wastes: Collection of wastes- Waste storage devices, Collection system parameters, Collection equipments, Collection methods, Transportation equipments; Transfer stations; Processing of solid wastes; General, physical, chemical and biological properties of solid wastes, Bulkiness, Combustibility, Solubility & Perishability of solid wastes; Solid wastes and disease vectors.	12 L
Unit 4	Effects of solid wastes: Social and aesthetic impacts of terrestrial pollution; Occupational and community health hazards; Interaction of terrestrial pollution with air and water pollution; Agricultural land and its effects on environment; Effects of mining and transportation activities; Cost of terrestrial pollution.	08 L
Unit 5	Pollution from production methods: Pollution from oil, coal, wood and agro-residues burning; Pollution from food industries, chemical manufacturing industries, agro- industries, petroleum refineries & metal plants; Environmental effects of nuclear, thermal and hydel power production methods.	08 L
Unit 6	Management of solid wastes: Physical methods- Open dumping, sanitary landfill, ocean dumping & incineration; Chemical methods- Pyrolysis & Gasification; Biological methods- Composting and vermicomposting; Energy recovery from solid wastes; 3-R strategy of solid waste management; Integrated Waste Management (IWM); Management of hazardous wastes- Neutralization, oxidation, encapsulation, incineration, secure landfill & deep well injection.	12 L
<p>Suggested readings:</p> <ol style="list-style-type: none"> A. D. Bhide and B.B. Sundersen, Solid Waste Management in Developed Countries, INSDOC, New Delhi (1983) Sinha R. K., Sinha A. K., Saxena V. S., A Book on Waste Management, INA, Shri publishers, Jaipur (2000) Robert A. Corbitt, Standard Handbook of Environmental Engineering, Mc-Graw Hill, (1989) E. D. Enger, B.F. Smith, Environmental Science - a study of interrelationships. 5th Edn. W.C.B. Publ., London. (1995) D. Botkin and E. Keller, Environmental Science - Earth as a Living Planet. John Wiley and Sons, Inc., New York, (1997) 		

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 203.1	The students will understand the technical, legal and economic aspects of general solid waste management and optimization of waste management system.	2
C 203.2	The students will learn legal and technical aspects of collection, transportation and management of hazardous wastes.	3

CORE COURSE	
EES-204: PRACTICAL COURSE ON AIR AND NOISE POLLUTION	
	Course Objectives: 1. To impart training on collection of air samples and monitoring of air pollutants. 2. To impart training on noise monitoring.
1	Study of micrometeorological equipments.
2	To study principle, components and working operation of respirable dust sampler.
3	To study principle, components and working operation of stack monitoring kit.
4	Determination of NO _x from ambient air.
5	Determination of SO _x from ambient air.
6	Determination of RPM and TSPM from ambient air.
7	Construction of windrose and study of wind profiles.
8	Measurement of noise levels.
9	Evaluation of impact of refuse on physical parameters of soil quality.
10	Evaluation of impact of refuse on chemical parameters of soil quality.
11	Determination of CO ₂ & O ₂ by Orsat apparatus.
12	Analysis of physical parameters of solid waste.
13	Analysis of chemical characteristics of solid waste.
14	Determination of pollution load through leachate of solid waste dump.
15	Estimation of dust falls by slide and beaker method.
16	Collection and Interpretation of weather data.
	Suggested readings: 1. Purohit, Air Environment and Pollution 2. S.K. Maiti, Soil and air analysis 3. V.K. Prabhakar, Solid Waste Management 4. P.N. Prasad, Environmental Law and Pollution Control 5. CPCB, Guidelines for the measurement of Ambient Air Pollutants (2011)

Course Outcomes (COs):

After completing this course graduate should able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 204.1	On completion of this course, the student will be able to undertake air sample collection its analysis, noise monitoring and comparing it with permissible standards and develop analysis report writing skill.	4

CORE COURSE	
EES- 205: PRACTICAL COURSE ON WATER POLLUTION	
	<p>Course Objectives:</p> <ol style="list-style-type: none"> To impart training on collection and analysis of physicochemical parameters of water samples. To impart training on estimation of microbiological parameters of water and wastewater samples.
1	Estimation of chlorides in water sample by Mohr's method.
2	Estimation of residual chlorine in water sample by iodometric method.
3	Estimation of sulphate in water sample by turbidimetric method.
4	Estimation of sulphite in water sample by titrimetric Method.
5	Estimation of ferric and ferrous iron present in water.
6	Estimation of chromium in water.
7	Estimation of nitrate in water.
8	Estimation of fluoride in water.
9	Determination of Chemical Oxygen Demand (COD) in wastewater.
10	Determination of Biological Oxygen Demand (BOD) of a wastewater.
11	Determination of Most Probable Number (MPN) in water.
12	Determination of total acidity and CO ₂ in water.
13	Determination of total bacterial and fungal count from garbage piles in housing colonies.
14	Determination of oil/grease in water.
15	Determination of Inorganic Phosphorus in water.
16	Conduction of Jar Test for coagulation/flocculation of water and wastewater.
	<p>Suggested readings:</p> <ol style="list-style-type: none"> American Public Health Association (APHA), Standard methods for examination of water and wastewater. S.K. Maiti, Handbook of water and wastewater analysis. Noor, Environment and Water Pollution cause Effect and Control. Mike Calver, Alan Lymbery, Jennifer McComb and Mike Bamford, Environmental Biology. Arvind Kumar, Environmental Biology. Ian L. Pepper and Charles P. Gerba, Environmental Microbiology: A Laboratory Manual.

Course Outcomes (COs):

After completing this course graduate should able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C 205.1	On completion of this course, the student will be able to collect water and wastewater samples and analyses them for physicochemical and microbiological parameters and comparing it with permissible standards and develop analysis report writing skill.	3

M.Sc. Part I Semester II (Environmental Science): Audit Courses

AC-201(A): Soft Skills (Personality and Cultural Development Related Audit course; Practical; 2 Credits) (Optional: Campus-level)		
	<p><i>Course Objectives (COs):</i></p> <ul style="list-style-type: none"> To inculcate different soft skills among students. 	
Unit 1	<p>Introduction to soft skills Formal definition, Elements of soft skills, Soft vs. Hard skills, Emotional quotient, Goal setting, life skills, Need for soft skills, Communication skills, Etiquettes & Mannerism.</p>	2 hrs.
Unit 2	<p>Self-Assessment Goal setting, SWOT analysis, attitude, moral values, self-confidence, etiquettes, non-verbal skills, achievements, positive attitude, positive thinking and self-esteem. Activity: The teacher should prepare a questionnaire which evaluate students in all the above areas and make them aware about these aspects.</p>	4 hrs.
Unit 3	<p>Communication Skills Types of communication: Verbal, Non-verbal, body language, gestures, postures, gait, dressing sense, facial expressions, peculiarity of speaker (habits). Rhetoric speech: Prepared speech (topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver, Extempore speech (students deliver speeches spontaneously for 5 minutes each on a given topic), Storytelling (Each student narrates a fictional or real-life story for 5 minutes each), Oral review (Each student orally presents a review on a story or a book read by them) Drafting skills: Letter, Report & Resume writing, business letters, reading & listening skills Activity: The teacher should teach the students how to write the letter, report and build resume. The teacher should give proper format and layouts. Each student will write one formal letter, one report and a resume.</p>	8 hrs.
Unit 4	<p>Formal Group Discussion, Personal Interview & Presentation skills Topic comprehension, Content organization, Group speaking etiquettes, driving the discussion & skills. Preparation for personal interview: dress code, greeting the panel, crisp self-introduction, neatness, etiquettes, language tone, handling embarrassing & tricky questions, graceful closing. Activity: Each batch is divided into two groups of 12 to 14 students each. Two rounds of a GD for each group should be conducted and teacher should give them feedback. Mock interview are to be conducted.</p>	4 hrs.
Unit 5	<p>Aptitude and analytical skills Quantitative aptitude, Numerical reasoning, verbal reasoning, diagrammatic test, situational tests, logical thinking. Analytical skills: Definition, Types, problem solving</p>	8 hrs.
Unit 6	<p>Life skills Time management, critical thinking, sound and practical decision making by dealing with conflicts, stress management, leadership qualities Activity: The teacher can conduct a case study activity to train students for decision making skills. The teacher should conduct a session on stress management and guide students on how to manage stress. The teacher may conduct a stress relieving activity in the class. He/she may counsel students individually to know their problems and guide them on dealing with them effectively.</p>	4 hrs.
<p>Suggested readings:</p> <ol style="list-style-type: none"> Basics of Communication In English: Francis Sounderaj, MacMillan India Ltd. English for Business Communication: Simon Sweeney, Cambridge University Press An Introduction to Professional English and Soft Skills: Das, Cambridge University Press Quantitative Aptitude: R.S. Agrawal 		

Course Outcomes (COs):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC201A.1	Identify their lacunas about some soft skills and try to overcome the same.	2
AC201A.2	Practice learned soft skills in real life and do their jobs more effectively.	3

AC-201(B): Practicing Sports Activities (Personality and Cultural Development Related Audit course; Practical; 2 Credits) (Optional: Campus-level)				
Course Objectives (COs):				
<ul style="list-style-type: none"> To motivate students towards sports and provide them required training. 				
SR NO.	NAME OF THE SPORT/GAME (Select ONE of the Following)	SYLLABUS OF THE COURSE	TIMING (02 Hours in a Week)	SEMESTER
1	Volleyball	<ul style="list-style-type: none"> General Fitness Basic Fitness Specific Fitness History of the Game Basic Skill of the Game Major Skill of the Game Technique & Tactics of the Game Game Practice 	Morning : 07 to 09 AM OR Evening : 05 to 07 PM	Total 30 Hours in Each Semester
2	Athletics			
3	Badminton			
4	Cricket			
5	Basketball			
6	Handball			
7	Kabaddi			
8	Kho-Kho			
9	Table-Tennis			
10	Swimming			

Course Outcomes (COs):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC201B.1	Identify one or more sports of their choice and develop more interest to participate at University/National level sport events.	2
AC201B.2	Practice the learned sports activities regularly in real life.	3

AC-201(C): Practicing Yoga (Personality and Cultural Development Related Audit course; Practical; (2 Credits) (Optional: Campus-level)	
Course Objectives:	
<ul style="list-style-type: none"> To motivate students towards yoga and provide them required training. 	

<ul style="list-style-type: none"> • Yog: Meaning, Definition & Introduction, Objectives • Primary Introduction of Ashtanga Yoga • Preparation of Yogabhyas • Omkar Sadhana, Prayer, Guru Vandana • Sukshma Vyayamas • Suryanamaskar (12 Postures) • Asanas : <ul style="list-style-type: none"> ▪ Sitting (Baithaksthiti) - Vajrasana, Padmasana, Vakrasana, Ardha-Pashchimotanasana ▪ Supine (Shayansthiti) - Uttan Padaasan(Ekpad/Dwipad), Pavanmuktasana, Viparitakarani Aasan, Khandarasan, Shavasana ▪ Prone (Viparitshayansthiti) - Vakrahasta, Bhujangasana, Saralhasta Bhujangasana, Shalabhasana(Ekpad/Dwipad), Makarasana ▪ Standing (Dhandsthiti) - Tadasana , TiryakTadasana, Virasana, Ardh Chakrasana • Primary Study of Swasana: Dirghaswasana, Santhaswasana, JaladSwasana - 6 Types • Pranayama : Anuloma-viloma, Bhramari
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Course Outcomes (COs):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC201C.1	Identify and practice some Yoga asanas regularly in their life to remain healthy.	2
AC201C.2	Provide guidance and practice about Yoga to their friends, parents and relatives.	3

AC-201(D): Introduction to Indian Music (Personality and Cultural Development Related Audit course; Practical; 2 Credits) (Optional: Campus-level)	
	<p>Course Objectives:</p> <ul style="list-style-type: none"> • To motivate students towards Indian music and provide them minimum required training.
	<ul style="list-style-type: none"> • Definition and brief about generation of Swar, Saptak, Thaata, Raaga, Aavartan, Meend, Khatka, Murkee, Taal, Aalaap etc. • Taal and its uses - Treetaal, Daadraa, Zaptaal, Kervaa. • Information of Badaakhyaal, Chhotaakhyaal (one), Sargam, Lakshangeet (information) • Detailed information of Tambora • Detailed information of Harmonium and Tablaa. • Five filmy songs based on Indian Classical Music (Theory and Presentation) • Sound Management - Basic information of Sound Recording (including Practicals) • Composition of Music as per the Story • Preparing news write-ups of the Seminars, Library Musical Programmes held at the nearest Akashwani, by personal visits.

Course Outcomes (COs):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC201D.1	Identify different types of Indian music.	3
AC201D.2	Develop more interest to learn and practice Indian music.	4

**M. Sc. PART II (ENVIRONMENTAL SCIENCE)
(SEMESTER -III and IV)**

Distribution of Course papers for M. Sc. Part II Environmental Science

Subject Code	Title of the Paper		Duration (Hrs./Wk)	Max. Mark	Exam. Time (Hrs.)
M.Sc. Part II (Environmental Science)					
Semester III : Theory Courses					
EES-301	Remote Sensing and Computer Application	Core course	04	100	03
EES-302	Environmental Monitoring for EIA	Core course	04	100	03
EES-303(A)	Pollution Control and Waste Management	Elective	04	100	03
EES-303(B)	Advanced Pollution Control Technologies	Elective	04	100	03
Semester III : Practical Courses					
EES-304	Practical Course on Environmental Monitoring	Core course	04+04	100	06
EES-305	Practical Course on Pollution Control and Waste Management	Core course	04+04	100	06
AC-301 A/B/C/D	AC-301 A: Computer Skills (T)/ AC-301 B: Cyber Security / AC-301 C: Rainwater Harvesting and /AC-301 D: Ecotourism	Audit Course	02	100	
Semester IV : Theory Courses					
EES-401	Environmental Policies and Legislation	Core course	04	100	03
EES-402(A)	Safety Legislations and Management	Elective	04	100	03
EES-402(B)	Safety Legislations and Management	Elective	04	100	03
EES-403	Nature Resources and Biodiversity Conservation	Core course	04	100	03
Semester IV : Practical Courses					
EES-404	Practical Course on Industrial Visits	Core course	04+04	100	06
EES-405	Practical Course on Research Dissertation	Core course	04+04	100	06
AC-401 A/ AC-401 B/ AC-401 C / AC-401 D	AC-401 A: Human Rights/ AC-401 B: Current Affairs/ AC-401 C: Green Audit/ AC-401 D: Watershed Management	Audit Course	02	100	

SEMESTER-III

CORE COURSE		
EES-301: REMOTE SENSING AND COMPUTER APPLICATIONS		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To develop basic understanding of remote sensing, GIS and GPS tools. 2. To understand the importance of satellite and information technology for solving out environmental problem. 3. To interpret and develop understandings on applications of satellite imageries and maps. 	
Unit 1	<p>Introduction to remote sensing: Definition, Historical perspective, Electromagnetic radiations (EMR), EMR spectrum, EMR quantities, Radiation laws, Black body and real body radiation, Hemispheric reflectance, Transmittance, Absorbance, Application of remote sensing in environmental studies.</p>	06 L
Unit 2	<p>Interaction of electromagnetic radiation (EMR) and remote sensing: With earth surface: reflection, transmission, spectral signatures. With the atmosphere: scattering, absorption, refraction, Types of remote sensing, necessity, importance and scope of remote sensing, Characteristics of remote sensing, Platforms and orbits: ground based, air borne, space borne Orbits: geostationary satellites and polar-orbiting satellites Sensors: MSS and TM scanners in landsat series, HRV scanners in spot series, LISS, PAN and WiFS scanners in IRS series</p>	12 L
Unit 3	<p>Aerial photography: Definition, Photogrammetry, Flight lines of vertical aerial photography, Types of aerial photography, Types of films, Measurements of heights and slopes from aerial photographs, Aerial photo interpretation. Differences between aerial photography and remote sensing.</p>	10 L
Unit 4	<p>Application of remote sensing in environmental studies: Land use / land cover; Wastelands; Forest, Forest fires; Water resources, Disasters; Wildlife habitat, Vegetation.</p>	08 L
Unit 5	<p>Computer and statistical applications:</p> <ol style="list-style-type: none"> 1. Fundamental of statistics: Collection of Data, classification and tabulation, Diagrammatic representation. Measures of central tendencies: Introduction, arithmetic mean, median mode characteristic of good average. Measure of dispersion: Introduction, measures of studying variation, Range, standard deviation, variance, mean deviation, coefficient of variation. 2. Some probability distributions: binomial, Poisson and normal distribution 3. Applied statistics: Review of Descriptive statistics, Correlation analysis, Regression analysis: Introduction, simple linear regression, fitting of regression line, ANOVA. 	12 L
Unit 6	<p>Geographical information system (GIS): GIS: definition, capabilities and advantages, History of GIS, Objectives of GIS, Elements of GIS, Data model: Raster and vector data model, Data structures: relational, hierachical and network data structures, Overview of GIS softwares, Use of GIS in environmental management</p>	12 L
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. Principles of Remote Sensing: A.N. Patel and S. Singh, Scientific Publishers (India), Jodhpur (1999). 2. Remote Sensing of the Environment: J.R.Jensen, Pearson Education Inc, Delhi(2003). 3. Remote Sensing for Environment and Forest Management: A. Mehrotra and R.K. Suri, Indus Publishing Co., New Delhi (1994). 4. Remote Sensing for Large Wildfires: E. Chuvieco, Springer, New York (1999). 5. Introduction to Geographic Information System: Chang, Kang-tang, Tata McGraw Hill, New Delhi (2002). 6. Geographic Information System: R.Ram Mohan Rao and A. Sharieff, Rawat Publication, New Delhi, (2002). 		

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C301.1	The students will be able to understand working principles of remote sensing and history of satellite development in India and globally, Interpretation of satellite images, Aerial photographs and derive conclusions, classify land use and land cover based on various tools.	2

SKILL BASED COURSE		
EES-302: ENVIRONMENTAL MONITORING FOR EIA		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 4. To impart thorough and in-depth knowledge on techniques /tools to be adopted for sustainable development. 5. To provide in depth understanding of methodologies for environmental monitoring for EIA. 6. To prepare the students for scientific/technical drafting of EIA report. 7. To impart knowledge about classification, storage, transportation and management of hazardous wastes. 	
Unit 1	Environmental impact assessment (EIA): Definition of EIA and EIS, Environmental inventory, Concepts, scope and objectives of EIA; National Environmental Policy Act (NEPA, 1969); EIA guidelines-1994 (Notification of Government of India), Procedure to review report of Environmental impact assessment.	10 L
Unit 2	Impact assessment methodologies: Definition and concept of impact; Types of impacts (Negative & Positive: Primary & Secondary; Reversible and Irreversible; Tangible and Intangible); Impact identification; Methods for impact identification: Matrices, networks and checklists, Advantage & disadvantages of EIA methodologies.	10 L
Unit 3	Components of EIA: Environmental Setting; Baseline data; Prediction and evaluation of impacts; Environmental management plan and monitoring, Baseline information, Prediction, evaluation and mitigation of impacts on socio-economic, air water, soil and noise environment.	12 L
Unit 4	Public participation in EIA: Decision making, Public participation in environmental decision making, Objectives and techniques for public participation, Advantages and disadvantages of public participation.	08 L
Unit 5	Preparation and writing of EIA: For water resources, Dams and irrigation projects; Mining and Infrastructural projects etc.	08 L
Unit 6	Environmental auditing: Notification and guidelines for Environmental audit; Scope, applicability and objective of environmental audit; procedure of environmental auditing; Water, raw material and energy balance; Hazardous waste audit, Safety audit; Applicability of statutory environmental audit statement.	12 L

Suggested readings:

1. Environment Impact Assessment: Larry W. Canter, Mc-Graw Hill Inc., New York (1996).
2. Introduction of Environmental Impact Assessment: John Glassion, Rikay Therival and A. Chadwick, UGC Press Ltd., London (1994).
3. Methods of Environmental Impact Assessment: Peter Morris, Ricky Therivel, UGC Press Limited, London (1994).
4. Environmental Impact Assessment & Management: Daya Publishing House, New Delhi (1998).
5. Using Environmental Management system to improve profits: B. Pearson, BFP Little and M. J. Brierley, Graham & Thotrman, Kluwer Academic Publisher Group, London(1992).
6. A monograph on Environmental Audit: The Institute of cost and works Accounts of India, New Delhi (1994)
7. Handbook of Environmental Impact Assessment (Vol. I): Judith Petts, Blackwell Science, USA (1999).
8. Handbook of Environmental Impact Assessment (Vol. II): Judith Petts, Blackwell Science, USA (1999).

Course Outcomes (COs):

After completing this course graduate should able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C302.1	The students will expertise in preparing protocols for environmental monitoring. The students will develop skills to work in EIA team. The case studies on EIA will orient students thoroughly for EIA report preparation.	6

ELECTIVE COURSE		
EES-303 (A): POLLUTION CONTROL AND WASTE MANAGEMENT		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> To impart thorough and in-depth knowledge on techniques /tools to be adopted for sustainable development. To provide in depth understanding of methodologies for environmental monitoring for EIA. To prepare the students for scientific/technical drafting of EIA report. To impart knowledge about classification, storage, transportation and management of hazardous wastes 	
Unit 1	Primary wastewater treatment: Necessity of wastewater treatment; Municipal & Industrial Wastewaters; Flow diagram of wastewater treatment plant; General design aspects of wastewater treatment plant; Preliminary treatments- Screen chamber, Grit basin, Skimming tank & Detritus tank; Primary treatments- Sedimentation, Primary clarifier & Final clarifier.	10 L
Unit 2	Secondary wastewater treatment: Introduction to secondary treatment; Trickling filter & Biological tower; Activated sludge process & its modifications; Low cost treatments- Sand filter, Contact bed, Rotating biological contactor, Septic tank, Oxidation pond and Lagoons.	10 L
Unit 3	Tertiary wastewater treatment: Introduction to tertiary treatment; Tertiary treatments- Chemical precipitation, Nitrification & denitrification, membrane filtration, reverse osmosis, ion exchange & electro-dialysis; Effluent disinfection- Chlorination, UV irradiation & Ozonation; Concept of Common Effluent Treatment Plant (CETP); Wastewater treatment for industries such as Petroleum refining, Fertilizer, Pesticide, Pulp and paper & Textile.	14 L
Unit 4	Sludge treatment: Origin & properties of sludges-primary-secondary, organic-inorganic & compressible-noncompressible; Thickening, Conditioning, Dewatering, Filtration, Digestion & Drying of sludges; Sludge disposal.	08 L
Unit 5	Solid waste management: SWM techniques- Land filling, Incineration, Pyrolysis, Composting & Biogas generation; Recycling & 3-R strategy; Integrated waste management; Hazardous waste management.	10 L
Unit 6	Air and noise pollution control: Control of particulate matters- Gravity settling chamber, Cyclone separator, Bag filter & Electrostatic precipitator; Control of gaseous pollutants- Scrubbing, Adsorption & Combustion; Noise pollution control- At source, During transmission & At receptor.	08 L
<p>Suggested readings:</p> <ol style="list-style-type: none"> Waste Water Engineering: Metcalf & Eddy, Tata Mc-Graw Hill Publishers, III Edition (1995) Water Supply and Sanitary Engineering: S. C. Rangwala, Charotar publishing house, Anand (1992) Water and Wastewater Technology: Mark J Hammer & Mark J Hammer Jr., Prentice Hall of India, IV Edition (2002) Environmental Pollution Control Engineering: C.S.Rao, New Age International (P) Ltd. (1991) Sewage Disposal and Air pollution engineering: S. K. Garg, Khanna publishers, New Delhi (1998) Air Pollution and Control: Mowli and Subbayya, Divyajyoti Prakashan, Jodhpur (1989) Air Pollution: V.P. Kudesia, Pragati Prakashan, New Delhi (1997) Noise Pollution and Management: G. Gaur, Sarup and Sons, New Delhi (1997) 		

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C303(A).1	The students will expertise in preparing protocols for environmental monitoring. The students will develop skills to work in EIA team. The case studies on EIA will orient students thoroughly for EIA report preparation.	6

ELECTIVE COURSE		
EES-303 (B): ADVANCED POLLUTION CONTROL TECHNOLOGIES		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> To impart knowledge on characterization, physico-chemical treatment and biological treatment of wastewater. To impart knowledge on storage and transport of hazardous wastes, biomedical wastes and e-wastes along with their management strategies. To impart knowledge on the principles and design of control of indoor/ particulate/ gaseous air pollutant and noise. 	
Unit 1	<p>Wastewater Pollution Control: Water Treatment: UV, H₂O₂, Ozonisation, chemical precipitation, disinfection, adsorption, softening, desalinization/demineralization, membrane processes. Biological treatment processes for wastewater- aerobic processes: Suspended floc type-the activated sludge processes. Extended aeration, Aerated lagoons, Waste stabilization ponds, rotating biological contact system, the trickling filter process. Anaerobic processes: Flow through systems and contact systems. UASB reactors and modifications. Sludge types, treatment and disposal. Processing of sludges- conditioning, thickening, dewatering, drying, incineration and disposal, Concept of common effluent treatment plant (CETP) their importance and advantages, role in wastewater treatment. Unit processes involved. Effluent discharge standards, industry specific minimum and national standards.</p>	14 L
Unit 2	<p>Hazardous Waste Management: Hazardous wastes: Sources and characteristics. Classification. Health and environmental effects. Safe storage, transport and treatment of. Stabilization and disposal Criteria for selection for secured and unsecured landfill disposal sites. Physicochemical methods and biological methods. Thermal Processes. Solidification/stabilization and innovation techniques. Secure landfill. Site selection methodology for establishing treatment and disposal methods. Radioactive waste: sources, classification, health and safety aspects. Control and Management of radioactive wastes</p>	10 L
Unit 3	<p>Biomedical Waste Management: Biomedical Waste: Definition, Sources of generation, categories, colour coding system for segregation, transportation specifications, treatment methods: Incineration, Microwave, Plasma Pyrolysis, Hydroclave etc. Treatment and disposal of Plastic waste, Treatment and disposal of metal sharps. Biomedical Waste (Handling and Management) Rules, 1998.</p>	10 L
Unit 4	<p>Electronic Waste Management: E-Waste: Sources of generation, categories, segregation, transportation, treatment methods: Plastic waste treatment and disposal. E-Waste (Handling and Management) Rules 2011</p>	08 L
Unit 5	<p>Air Pollution Control: Treatment Processes for Particulate matter: Absorption in liquids by Scrubbers, adsorption on solids. Combustion: flaring, thermal incineration, catalytic oxidation. Treatment Processes for other gaseous pollutants: Odour, VOCs, oxides of sulphur and nitrogen emissions. Indoor air quality management, principles and control measures, steps for improving indoor air quality. Auto-exhausts, its components. Control of auto-exhausts emissions. Emission specific control options, use of after burners, engine modifications / tuning; importance of good maintenance and driving habits.</p>	12 L
Unit 6	<p>Noise Pollution Control: Physics of Sound, Noise - Sources and Standards, Measurement and Control of Noise Pollution. Noise pollution control at source, in path and to receiver.</p>	06 L

Suggested readings:

1. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third Edition, McGraw Hill, 1991.
2. R. C. Rangwala and S. C. Rangwala, Water Supply & Sanitary Engineering, Charotal Publishing House, Anand.
3. M. N. Rao, A. K. Datta, Wastewater Treatment, IBH Publishing Company, New Delhi.
4. W.W. Eckenfelder, Industrial pollution control, McGraw Hill, Int-Edition, 1990.
5. Rao C.S., Environmental pollution control engineering, Willey Eastern Ltd., New Delhi.
6. Rao M.N. & Rao H.V.N., Air Pollution, Tata McGraw-Hill, 1989.
7. S.S.Dara, A text book of Environmental Chemistry and Pollution Control
8. Manual on Municipal Solid Waste Management, Ministry of Urban Development, Government of India, New Delhi, 2000.
9. Freeman H.M., Standard Handbook of Hazardous Waste Treatment and Disposal., 1989

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C303(B).1	Students will acquire the skill of operating various processes of wastewater treatment plant and develop technologies for storage, handling and management of hazardous wastes. Students will understand the technologies used for control of air and noise pollution.	3

CORE COURSE

EES- 304: PRACTICAL COURSE ON ENVIRONMENTAL MONITORING

Course Objectives:

1. To impart training on collection and analysis of air samples.
2. To impart training on statistical analysis of experimental data.
3. To impart training on understanding and application GIS softwares.

1	To analyze auto exhaust for PUC
2	Interpretation of aerial photographs.
3	Use of GIS software for environment studies
4	Determination of height of the object in aerial photographs
5	Interpretation of satellite images
6	Study of energy plants.
7	Impact of air pollution on photo density flux of plant leaves.
8	To study the impact of flood on ecology.
9	To estimate the effect of exhaust gases on chlorophyll content in different plants.
10	Determination energy content of biomass.
11	Assessment of urban / Industrial forestry.
12	Computations of measures of central tendency Viz: mean, mode, median etc. and graphical representation of data through histogram, dot plot, box plot
13	Computation/calculation of measures of dispersion for datasets based on environmental experiments viz: soil testing, air temperature, bacteria analysis, water wasted data, green house/ watershed managements etc.
14	Computation/calculation of correlation for datasets based on environmental experiments, viz: scatter plot for bivariate data, fitting of regression lines, ANOVA, calculation of R ² .

Suggested readings:

1. Rao, M.N., and Rao, H.V.N., Air pollution. Tata McGraw-Hill Publishing Co. Ltd., New Delhi 1989.
2. S.K. Maiti, Handbook of Methods in Environmental Studies-Air, Noise, Soil and Overburden analysis. Oxford book company.
3. CPCB, Guidelines for the Measurement of Ambient Air Pollutants, Volume-1, Delhi.
4. Sahoo, R.N., Sehgal, V.K., Pradhan, S., Gupta, V.K. and Kamble, K.H., Practical Manual on Basics of Remote Sensing Data Processing, GPS and GIS, Division of Agricultural Physics, Indian Agricultural Research Institute, New Delhi.
5. Practical Manual for RS and GIS with Quantum GIS Paperback by Jagadish Kumar Mogaraju.
6. ESRI online training website: <https://www.esri.com/training/catalog/search/>
7. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House Pvt. Ltd., 7th Edition.
8. John Townend, Practical Statistics for Environmental and Biological Scientists, Wiley.

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C304.1	On completion of this course, the student will be able to collect air samples and analyse them for various parameters and comparing it with permissible standards.	4
C304.2	Students will acquire skill of statistical analysis and representation of data. Students will learn applications of GIS softwares in environmental management.	3

ELECTIVE COURSE**EES- 305: PRACTICAL COURSE ON POLLUTION CONTROL AND WASTE MANAGEMENT****Course Objectives:**

1. To impart training on collection and analysis of air and water samples.
2. To impart training on noise monitoring and impact evaluation.
3. To learn about water and wastewater treatment processes.

1	To determine the ambient air quality in industrial belt.
2	Study on noise and dust pollution in flourmills.
3	To evaluate the impact of traffic density on mix environment.
4	To study the effluent characteristics of pulp and paper industry.
5	To study pollution potential of dairy effluent.
6	Analysis of textile mill effluent.
7	Estimation of MLSS, MLVSS from the sewage.
8	Determination of chlorine demand for drinking water.
9	To study environmental status of thermal power plant.
10	To draw the flow chart for industrial effluent treatment.
11	Design of settling tank.
12	Design of aeration tank.
13	To compare the impact of chemical pesticides v/s bio-pesticides on micro flora.
14	To examine the effect of chemical v/s bio-fertilizers on root ramification and plant growth.

Suggested readings:

1. American Public Health Association (APHA), Standard methods for examination of water and wastewater.
2. S.K. Maiti, Handbook of Methods in Environmental Studies- Water and waste water analysis, Oxford book company.
3. Metcalf & Eddy, Wastewater Engineering-Treatment and Reuse, Fourth Edition (Indian), McGraw-Hill Higher Education.
4. Water Supply and Sanitary Engineering: S. C. Rangwala, Charotar publishing house, Anand (1992)
5. Environmental Pollution Control Engineering: C.S.Rao, New Age International (P) Ltd. (1991)
6. Sewage Disposal and Air pollution engineering: S. K. Garg, Khanna publishers, New Delhi (1998)
7. Ian L. Pepper and Charles P. Gerba, Environmental Microbiology: A Laboratory Manual.

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C305.1	On completion of this course, the student will be able to collect air and water samples and analyse them for pollution potential	4
C305.2	Students will acquire skill of noise monitoring and impact evaluation. Students will learn wastewater treatment processes.	5

M.Sc. Part II Semester III (Environmental Science): Audit Courses

AC-301(A): Computer Skills (Technology + Value added Audit course; Practical; 2 Credits) (Optional: Campus + Program level)		
Course Objectives (CObs): <ul style="list-style-type: none"> • To inculcate different daily useful computer skills among students. 		
Unit 1	Elements of Information Technology <ul style="list-style-type: none"> ❖ Information Types: Text, Audio, Video, and Image, storage formats ❖ Components: Operating System, Hardware and Software, firmware ❖ Devices: Computer, Mobile Phones, Tablet, Touch Screen, Scanner, Printer, Projector, smart boards ❖ Processor & Memory: Processor functions, speed, Memory types: RAM /ROM /HDD /DVD-ROM/Flash drives, memory measurement metrics 	2 hrs
Unit 2	Office Automation-Text Processing <ul style="list-style-type: none"> ❖ Views: Normal View, Web Layout View, Print Layout View, Outline View, ReadingLayout View ❖ Working with Files: Create New Documents, Open Existing Documents, SaveDocuments to different formats, Rename Documents, Close Documents ❖ Working with Text: Type and Insert Text, Highlight Text, Formatting Text, Delete Text, Spelling and Grammar, paragraphs, indentation, margins ❖ Lists: Bulleted and Numbered Lists, ❖ Tables: Insert Tables, Draw Tables, Nested Tables, Insert Rows and Columns, Moveand Resize Tables, Moving the order of the column and/or rows inside a table, TableProperties ❖ Page Margins, Gutter Margins, Indentations, Columns, Graphics, Print Documents, ❖ Paragraph Formatting, Paragraph Attributes, Non-printing characters ❖ Types of document files: RTF, PDF, DOCX etc. 	5 hrs
Unit 3	Office Automation-Worksheet Data Processing <p>3.1 Spreadsheet Basics: Adding and Renaming Worksheets, Modifying Worksheets,</p> <p>3.1 Spreadsheet Basics: Adding and Renaming Worksheets, Modifying Worksheets,</p> <p>3.2 Moving Through Cells, Adding Rows, Columns, and Cells, Resizing Rows and Columns, Selecting Cells, Moving and Copying Cells</p> <p>3.3 Formulas and Functions: Formulas, Linking Worksheets, Basic Functions, AutoSum, Sorting and Filtering: Basic Sorts, Complex Sorts, Auto-fill, Deleting Rows, Columns, and Cells</p> <p>3.4 Charting: Chart Types, drawing charts, Ranges, formatting charts</p>	5 hrs
Unit 4	Office Automation- Presentation Techniques and slide shows <p>4.1 Create a new presentation, AutoContent Wizard, Design Template, Blank Presentation, Open an Existing Presentation, PowerPoint screen, Screen Layout</p> <p>4.2 Working with slides: Insert a new slide, Notes, Slide layout, Apply a design template, Reorder Slides, Hide Slides, Hide Slide text, Add content, resize a placeholder or textbox, Move a placeholder or text box, Delete a placeholder or text box, Placeholder or Text box properties, Bulleted and numbered lists, Adding notes</p> <p>4.3 Work with text: Add text and edit options, Format text, Copy text formatting, Replace fonts, Line spacing, Change case, Spelling check, Spelling options</p> <p>4.4 Working with tables: Adding a table, Entering text, Deleting a table, Changing row width, Adding a row/column, Deleting a row/column, Combining cells, Splitting a cell, Adding color to cells, To align text vertically in cells, To change table borders, Graphics, Add clip art, Add an image from a file, Save & Print, slide shows, slide animation/transitions.</p>	6 hrs
Unit 5	Internet & Applications: <p>5.1 Computer Network Types: LAN, PAN, MAN, CAN, WAN, Defining and describing the Internet, Brief history, Browsing the Web, Hypertext and hyperlinks, browsers, Uniform resource locator</p> <p>5.2 Internet Resources: Email, Parts of email,</p>	4 hrs

	5.3 Protecting the computer: Password protection, Viruses, Virus protection software, Updating the software, Scanning files, Net banking precautions. 5.4 Social Networking: Features, Social impact, emerging trends, issues, Social Networking sites: Facebook, Twitter, linkedin, orkut, online booking services 5.5 Online Resources: Wikipedia, Blog, Job portals, C.V. writing 5.6 e-learning: e-Books, e-Magazines, e-News papers, OCW(open course wares): Sakshat(NPTEL) portal, MIT courseware	
Unit 6	Cloud Computing Basics 6.1 Introduction to cloud computing 6.1 Introduction to cloud computing 6.2 Cloud computing models: SAS, AAS, PAS 6.3 Examples of SAS, AAS, PAS (DropBox, Google Drive, Google Docs, Office 365 Prezi, etc.)	3 hrs
Suggested readings:		
1. TCI, "Introduction to Computers and Application Software", Publisher: Jones & Bartlett Learning, 2010, ISBN: 1449609821, 9781449609825		
2. Laura Story, Dawna Walls, "Microsoft Office 2010 Fundamentals", Publisher: Cengage Learning, 2010, ISBN: 0538472464, 9780538472463		
3. June Jamrich Parsons, Dan Oja, "Computer Concepts Illustrated series", Edition 5, Publisher Course Technology, 2005, ISBN 0619273550, 9780619273552		
4. Cloud computing online resources		

Course Outcomes (COts):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC301A.1	Identify their lacunas about some computer skills and try to overcome the same.	2
AC301A.2	Practice the learned computer skills in real life and do their jobs more effectively.	3

AC-301(B): Cyber Security (Technology + Value added Audit course; Practical; 2 Credits) (Optional: Campus + Program level)		
Course Objectives (CObs):		
<ul style="list-style-type: none"> To make students aware of different daily useful cyber security skills/rules. 		
Unit 1	Networking Concepts Overview Basics of Communication Systems, Transmission Media, ISO/OSI and TCP/IP models, Network types: Local Area Networks, Wide Area Networks, Internetworking, Packet Formats, Wireless Networks: Wireless concepts, Advantages of Wireless, Wireless network architecture, Reasons to use wireless, Internet	3 hrs
Unit 2	Security Concepts Information Security Overview, Information Security Services, Types of Attacks, Goals for Security, E-commerce Security, Computer Forensics, Steganography. Importance of Physical Security, Biometric security & its types, Risk associated with improper physical access, Physical Security equipments. Passwords: Define passwords, Types of passwords, Passwords Storage – Windows & Linux.	7 hrs
Unit 3	Security Threats and vulnerabilities Overview of Security threats, Hacking Techniques, Password Cracking, Types of password attacks, Insecure Network connections, Wi-Fi attacks & countermeasures, Information Warfare and Surveillance. Cyber crime: e-mail related cyber crimes, Social network related cyber crimes, Desktop related cyber crimes, Social Engineering related cyber crimes, Network related cyber crimes, Cyber terrorism, Banking crimes	7 hrs

Unit 4	Cryptography Understanding cryptography, Goals of cryptography, Types of cryptography, Applications of Cryptography, Use of Hash function in cryptography, Digital signature in cryptography, Public Key infrastructure	5 hrs
Unit 5	System & Network Security System Security: Desktop Security, email security: PGP and SMIME, Web Security: web authentication, Security certificates, SSL and SET, Network Security: Overview of IDS, Intrusion Detection Systems and Intrusion Prevention Systems, Overview of Firewalls, Types of Firewalls, VPN Security, Security in Multimedia Networks, Fax Security.	3 hrs
Unit 6	OS Security OS Security Vulnerabilities updates and patches, OS integrity checks, Anti-virus software, Design of secure OS and OS hardening, configuring the OS for security, Trusted OS.	2 hrs
Unit 7	Security Laws and Standards Security laws genesis, International Scenario, Security Audit, IT Act 2000 and its amendments.	3 hrs
Suggested readings:		
<ol style="list-style-type: none"> 1. Skills Factory, Certificate in Cyber Security, Text Book Special edition, Specially published for KBC NMU, Jalgaon 2. BPB Publication, “Fundamentals of Cyber Security”, Mayank Bhushan, Rajkumar Singh Rathore , Aatif Jamshed 3. CreateSpace Independent Publishing Platform, “Cyber Security Basics”, Don Franke, ISBN-13: 978-1522952190 ISBN-10: 1522952195 4. Online references 		

Course Outcomes (COs):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC301B.1	Practice learned cyber security skills/rules in real life.	3
AC301B.2	Provide guidance about cyber security skills/rules to their friends, parents and relatives.	2

AC-301(C): RAINWATER HARVESTING (Technology + Value added Audit course; Practical; 2 Credits) (Optional: Campus + Program level)	
<i>Course Objectives (COs):</i>	
<ol style="list-style-type: none"> 1. To make students aware of water scarcity and individuals’ role to save and conserve the most precious water resource. 	
CONTENT OF THE SYLLABUS	
1.	Water – Science & Hydrology
2.	Integrated Water Resource Management
3.	Water Harvesting Techniques & Management
4.	DEMONSTRATION: Demonstration of Success stories, Practicing Rainwater Harvesting and visit to Rainwater Harvesting structure.

Course Outcomes (COs):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC301C.1	Practice learned on field rainwater harvesting.	3
AC301C.2	Provide guidance about awareness about importance of harvesting to local community	2

AC-301(D): ECOTOURISM
 (Value added Audit course; Practical; 2 Credits)
 (Optional: Campus + Program level)

Course Objectives (COs):

1. To evaluate the ecotourism potential of given tourism site.
2. A student has to study and submit the report onsite.

CONTENT OF THE SYLLABUS

1.	Ecotourism: Concept, definition
2.	Social and ecological impacts of tourism.
3.	Strategies and tools for ecotourism development
4.	Components of ecotourism
5.	Ecotourism practices
6.	ASSIGNMENT: Assignment to evaluate the potential of given tourism site for development as ecotourism site. Students has to study and submit report.

Course Outcomes (COs):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC301D.1	Understand importance of environment and ecology.	3
AC301D.2	Acquire knowledge and understanding of resources, products, best management practices and opportunities in the ecotourism sub-sector.	2

SEMESTER-IV

CORE COURSE		
EES-401: INDUSTRIAL SAFETY, HYGIENE AND TOXICOLOGY		
	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To impart knowledge about concepts of workplace hazards and industrial hygiene along with practices to prevent occupational diseases and protect the health. 2. To impart knowledge about management of occupational safety and health. 3. To impart knowledge about theory, types, control and prevention strategies for accidents in an industrial sector. 4. To impart knowledge about understanding the toxicology of substances in an occupational setting. 	
Unit 1	<p>Industrial safety: History and development of safety movement; Safety legislation, Acts and Rules; Safety standards and codes, Safety policy; Safety organization and responsibilities and authorities of different levels; Accidents- Sequence theory, Causes & Prevention, Plant safety inspections, Job safety Analysis and Investigation of accidents, Safety committee- Role & Formation; Safety awareness programme- Motivation, Education and Training; Total loss control concept; Productivity, Quality, Reliability and Safety (PQRS) theory.</p>	12 L
Unit 2	<p>Risk assessment and management: Checklist procedure; Preliminary hazard analysis; What if analysis; Failure mode effect analysis; Hazard and Operability (HAZOP) studies; Hazard analysis techniques-Fault tree & Event tree analysis; DOW index; Risk estimation and management; On-site and Off-site emergency preparedness.</p>	08 L
Unit 3	<p>Specific hazards: Identification of hazard; Categorization methods for elimination of hazard; Mechanical hazards- Machine guarding, Safety with hand tools/ portable power tools, Pressure vessel hazards and their control; Safety in material handling; Safety with storage of materials; Electrical hazards- classification, Safe work practices; Chemical hazards- Laboratory safety, Bulk handling of chemicals; Fire and explosion hazards- Fire detection, Prevention, Control & extinguishments.</p>	12 L
Unit 4	<p>Industrial hygiene: Principles of industrial hygiene; Environmental stresses- Physical, Chemical, Biological and Ergonomic stresses; Physical stresses- Heat, Heat balance, Health effects, WBGT index & Control measures, Gases under high pressure; Chemical stresses- Chemical agents, IS/UN classification, Flammables, Explosives, Irritants, Oxidants, Asphyxiants, Anaesthetics, Toxic & Carcinogenic chemicals; Air sampling and evaluation methods, Occupational exposure limits, Engineering control measures.</p>	10 L
Unit 5	<p>Elementary industrial toxicology: Introduction; Definitions; Environmental agents causing public concern; Factors affecting toxicity; LD₅₀- Definition and uses, Dose response curve, Extrapolation of animal studies results to human, Probit factor; Carcinogenesis- Initiation, Promotion and Progression, Chemicals carcinogenesis, Threshold limit value (TLV); Morphological, functional and biochemical changes in Acute and Chronic exposures.</p>	10 L
Unit 6	<p>Occupational health: WHO definition of health, Concept of occupational health;</p>	08 L

	History of occupational health; Occupational and work-related diseases; Prevention of occupational diseases, Occupational health service; Personal protective equipments- Respiratory and Non-respiratory.	
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. Industrial Safety and pollution control handbook: National Safety Council and Associate publishers Pvt. Ltd, Hyderabad (1993). 2. Handbook of Environmental Health and Safety: Herman Koren and Michel Bisesi, Jaico Publishing House, Delhi (1999). 3. Environmental Toxicology and Chemistry: Donald G. Crosby , Oxford University Press, USA (1998). 4. Handbook of Environmental Risk Assessment and Management: Peter Calow, Blackwell Science Ltd. USA (1998). 5. Principals of Environmental Toxicology: Ian C. Shaw and John Chadwick, Taylor and Francis, USA (1998). 6. The Factories Act-1948, Government Printing Press, Civil lines, Delhi (1994). 7. Risk Assessment and Environmental Management: D. Kofi Asvite- Dually, John Willey & Sons, West Sussex, England (1998). 8. Introduction to Environmental Engineering & Science: Gilbert M. M., Pearson Education, Singapore (2004). 		

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C401.1	The students will gain knowledge to identify and resolve problems related with hygiene and safety at the industrial workplace.	2
C401.2	They will also be oriented to produce toxicological inputs in occupational safety assessments.	6
C401.3	The students will develop an ability to work in teams that establish goals, plan tasks and analyze risks for the various industrial projects.	3

ELECTIVE COURSE

EES-402 (A): ENVIRONMENTAL POLICIES AND LEGISLATION

	<p>Course Objectives:</p> <ol style="list-style-type: none"> To study need of laws, importance of environmental legislations, governmental policies for protection and development of environment. To analysed various strategies of pollution control techniques, NCEP and environmental policies resolutions. To understand the rearrange prevention and control rules, regulations and governmental policies. 	
Unit 1	Environmental policy: Population, industrialization and urbanization policies of GOI, International and Government of India's policies in the protection of environment; Environment action plan (EAP); Making of environmental laws; implementing the laws. National Forest Policy, 1989, National Water Policy, 2002.	10 L
Unit 2	Policy statement for abatement of pollution: Introduction, problems, objectives and future directions; Critical polluted areas and their standards; Constitutional provision regarding Environmental Protection (article 48 and 58 AG)	10 L
Unit 3	Leading case studies: The Environmental concern in India, Silent valley; Sardar Sarovar; Tehri Dam and Chipko Movement.	10 L
Unit 4	Global environmental awareness and action plan: Stockholm Conference (UNCHE); Montreal Protocol; UN conference on environment and development, Rio (UNCED) Summit; Population conference, Cairo and climatic change conference, Kyoto; International union for conservation of nature and natural resources (IUCN); UN environmental programmers (UNEP); World-wide fund for nature (WWF).	12 L
Unit 5	Environmental laws in India: The Factories Act,1948 and Amendment thereof; The Water (prevention and control of pollution) Act,1974; The Forest (conservation) Act,1980; The Air (prevention and control of pollution) Act,1981; The Environment (protection) Act,1986, Public Liability Insurance Act,1991, The Wildlife (protection) Act,1972.	10 L
Unit 6	Environmental rules in India: Hazardous Waste (management and handling) Rules,1989; Rules framed under industrial waste; Biomedical waste management rules; Noise and Environmental Pollution under Motor Vehicles Rules,1989; Noise Pollution (regulation and control) Rules, 2000; Coastal Zone Regulation,1991.	08 L
<p>Suggested readings:</p> <ol style="list-style-type: none"> A Text book in Environmental Sciences: Subramanian, Narosa Publishing House, New Delhi (2000). Environment and Pollution Law Manual: Mohanty S. K., Universal Law Publishing Co. Pvt. Ltd., New Delhi (2000). Environmental Policies: Sinha P. C., Anmol Publications Pvt. Ltd, New Delhi (1998). Environmental Geography: Savindra Singh, Prayag Pustak Bhawan, Allahabad (2002). Climate Change in Asia and Brazil: James G. Speth and Mohaned EL-Ashry, TERI, New Delhi (1994). Environmental Guidelines and Standards in India: Goel P. K and Sharma K. P, Techno Science Publications, Jaipur (1996). 		

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C402(A).1	Students will be able to understand Need of Law, Importance of Environmental Legislation.	2
C402(A).2	To recognize Prevention and Control Rules & Regulations, Government Policies for Protection & Development of Environment.	2

ELECTIVE COURSE

EES-402 (B): SAFETY LEGISLATIONS AND MANAGEMENT

	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To study need of laws, importance of industrial safety legislations, governmental policies for industrial safety and environmental protection. 2. To analysed various strategies of industrial Safety and Management. 3. To understand the rearrange prevention and control rules, regulations and governmental policies. 	
Unit 1	<p>Industrial Safety Legislations: Legislative measures in industrial safety: Factories Act, 1948, Workman’s Compensation Act,1943, Employees State Insurance Act, 1948. Mines Act, Air (Prevention and control) Pollution Act, 1981, Water (Prevention and Control) Pollution Act, 1974, Boiler Vessels Act. Child Labour and Women Employee Act. The factories rules, History, Provisions under the factories Act and rules made there under with amendments, Functions of safety management. ILO Convention and Recommendations in the furtherance of safety, health and welfare.</p>	12 L
Unit 2	<p>Occupational Safety, Health and Environment Management: Bureau of Indian standards on safety and health 14489 - 1998 and 15001 – 2000 OSHA, Process Safety Management (PSM) as per OSHA, PSM principles, OHSAS – 18001, EPA Standards, Performance measurements to determine effectiveness of PSM.</p>	08 L
Unit 3	<p>Industrial Safety Management: Management: Concept, definition, nature and importance, Role and functions of a manager, Elements and functions of Management. Management Principles: Authority, responsibility & power of Management, Span of Control. Delegation and decentralization of authority. General principles of Management.</p>	10 L
Unit 4	<p>Employee Participation in Safety Awareness & Training: Purpose, nature, scope and methods. Safety committee and union participation. Trade Unions: History of trade unions in India. Role of trade unions in safety and health. Collective bargaining and safety. Safety Promotion & Publicity: Safety suggestion schemes. Safety competitions, Safety incentive Schemes. Audio Visual Publicity, other promotional methods.</p>	10 L
Unit 5	<p>Human behavior and safety: Human factors contributing to accidents. Individual differences. Behaviour as function of self and situation. Perception of danger and acceptance of risks. Knowledge and responsibility vis-a-vis safety performance. A. Maslow’s, Herzberg’s, Douglas McGregor’s and Adam’s equity theories of motivation and their application to safety. Role of management, Supervisors and safety department in motivation.</p>	08 L
Unit 6	<p>Plant Cleanliness and Worker Safety: Concept of workplace and its design. Improving safety and productivity through work place design control measures. Technical and engineering control measures. Control measures against human error. Preventive maintenance. Role of Preventive maintenance in safety and health. Standards and code of practices for plant and equipment. Standardization and its benefits, Purchasing policy. Safety and good housekeeping. Need for planning and follow-up. Typical accidents due to poor housekeeping. Disposal of scrap and other trade wastes. Prevention of spillage. Marking of gangways and other locations. Use of colour as an aid for good housekeeping. Clean-up campaigns. Cleaning methods, employee assignment. Inspections and check-list. Result of good housekeeping. Plant safety observation, Plant Safety Inspections. Safety Sampling. Safety Surveys. Job Safety Analysis. Safety</p>	12 L

	Inventory System. Product Safety. Permit to work systems. Safety tag systems. Loss Control: Damage control & system safety.	
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. R. K. Jain and Sunil S. Rao, Industrial Safety, Health and Environment Management Systems, Khanna publishers, New Delhi (2006) 2. Slote. L. Handbook of Occupational Safety and Health, John Willey and Sons, New York. 3. Frank P. Lees, Loss of prevention in Process Industries, Vol. 1 and 2, Butterworth- Heinemann Ltd., London (1991). 4. Industrial Safety -National Safety Council of India. 5. The Factories Act with amendments 1987, Govt. of India Publications DGFASLI, Mumbai. 6. Industrial Safety Management, L. M. Daeshmukh, Mcgraw Hill. 7. Environment and Pollution Law Manual: Mohanty S. K., Universal Law Publishing Co. Pvt. Ltd., New Delhi (2000). 8. Environmental Policies: Sinha P. C., Anmol Publications Pvt. Ltd, New Delhi (1998). 9. Environmental Guidelines and Standards in India: Goel P. K and Sharma K. P, Techno Science Publications, Jaipur (1996). 		

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C402(B).1	Students will be able to identify Need of Law, Importance of Environmental Legislation.	2
C402(B).2	To recognize Industrial Safety Laws, Rules & Regulations, Government Policies for Industrial Safety management & Development of Environment.	2

CORE COURSE

EES-403: NATURE RESOURCES AND BIODIVERSITY CONSERVATION

	<p>Course Objectives:</p> <ol style="list-style-type: none"> To study different types of biodiversity and natural resources and to develop broad understanding of related key issues. To analysed different approaches for conservation and management of biodiversity and natural resource. To understand the natural resource and biodiversity in India and Northeast India. 	
Unit 1	Natural resource: Introduction, types of natural resources and their classification value, extraction and uses of natural resources. Conservation and management of natural resources, Conservation and protection, sustainable use of natural resources. Natural resource management approaches, Community based natural resource management (CBNRM) and Integrated natural resource management (INRM).	10 L
Unit 2	Conservation of resources: What are resources, types of resources, why soil conservation, forest resources, forest covers, deforestation, desertification, afforestation, agroforestry, social forestry and forest conservation through law.	10 L
Unit 3	Non-conventional energy sources and their programs in India: Biogas, Wind Mill (wind farm, Advantages and limitation, wind energy), Solar energy (SPV, ST), Geothermal energy, Nuclear energy (Nuclear reactor, Status of Nuclear power, Cost befit analysis) Hydro power (small hydel project), Tidal power.	10 L
Unit 4	Biodiversity: Importance of biodiversity, threats to biodiversity, causes and consequences of biodiversity loss, biodiversity and vulnerability to climate change, biodiversity and human health, measuring biodiversity, ecology and economy, bioethics and conservation, causes of extinction, in situ and ex situ, selection criteria for protection of species, IUCN conservation status, Red Data book, Biodiversity related national and international conventions and organizations. Biodiversity hotspots.	12 L
Unit 5	Conservation of biodiversity: Ethics in conservation of biodiversity. Management of biodiversity, Community reserve forest, Reserve forests, National Parks, Wildlife Sanctuary, Biosphere Reserve, Private/corporate forest. Traditional ecological knowledge, CBD, Participatory Rural Appraisal (PRA), Constrains of conservation.	10 L
Unit 6	Environmental Education: Concept, Definition, History, Objectives, Teacher training program, Environmental aspects need to be highlighted in EE, EE at various levels, Role of NGO's in EE.	08 L
<p>Suggested readings:</p> <ol style="list-style-type: none"> K.C. Agrawal, Environmental Biology, Agro-Botanical publishers, Bikaner. (1993) P. S. Verma, V. K. Agrawal, Environmental Ecology S. Chand & Co., New Delhi. (1998) P. D. Sharma, Ecology & Environment, Rastogi Publications, Meerat. (VII Edi.2000) Krishnamurthy K. V., An Advanced Textbook on Biodiversity: principles and Practice, Oxford & IBH Pub. Co. Pvt. Ltd., 2008. Maiti Prabodh K. and Maiti Paulami., Biodiversity: Perception, Peril and Preservation, PHI, New Delhi, 2001. pp.560. 		

Course Outcomes (COs):

After completing this course graduate should able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C403.1	Apply basic natural resource sampling techniques in different biodiversity areas and be proficient in summarizing and reporting data of present and extinct species	2

CORE COURSE

EES-404: PRACTICAL COURSE ON INDUSTRIAL VISITS

Course Objectives:

1. To provide students an insight regarding internal working of industries.
2. To provide an exposure to students about practical working environment.
3. This interaction gave the students an exposure to current work practices as opposed to possibly theoretical knowledge being taught at University department level.

Industrial visits: Sugar, Distillery, Dairy, Foundry, Textile, Pulp and Paper, Pharmaceutical, Chemical, Food Processing Agrochemical, Fertilizer, etc. Writing of report on the local industrial visits and long tour report.

Case study on EIA: Any one case study from the followings: Mining, Hydel, Irrigation and Thermal Power Plant

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C404.1	Theoretical knowledge but it is not enough for making a good professional career, so with aim to go beyond academics, industrial visit provides student a practical perspective. This will get good opportunity to develop full awareness about industrial practices	3

CORE COURSE
EES-405: PRACTICAL COURSE ON RESEARCH DISSERTATION
<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To prepare students for carrying out independent research on a topic of their choice within the field of environmental science and presenting an account of the research in the form of a dissertation. 2. To demonstrate skills and knowledge acquired throughout the taught component of the MSc programme. 3. Projects can take several forms, including a quantitative analysis of environmental data. 4. Students will be provided with guidance and support by teaching staff as a dissertation supervisor.
<p>Each student is required to work for on a research project assigned by a teacher. The project report is required to be submitted before the end IV semester examination. The evaluation includes a presentation and viva-voce examination by the students before external examiner.</p> <p>Dissertation topic on environmental protection and nature conservation. The students are expected to study the local environmental problems related to the following aspects during their dissertation.</p> <ol style="list-style-type: none"> a. Urban environmental problems. b. Quality of water resources. c. Industrial wastewater treatment technologies. d. Watershed management. e. Biodiversity. f. Reclamation of problematic soil. g. Bioremediation. h. Health effects of pollution. i. Environmental and socio-economic impacts of various human activities.

Course Outcomes (COs):

After completing this course graduate should be able to:

CO's Sr. No.	Course Outcomes	Cognitive level
C405.1	Identify key research questions within the field of environmental science on which they will carry out independent research.	2
C405.2	Manage their time effectively while working on their independent research. Demonstrate and understanding appropriate referencing and develop skills in other aspects of dissertation writing.	6
C405.3	To learn or describe the process of carrying out independent research in written format and report your results and conclusions with reference to existing literature and research findings	2

M.Sc. Part II Semester IV (Environmental Science): Audit Courses

AC-401(A): Human Rights (Professional and Social + Value Added Audit course; Practical; 2 Credits) (Optional: Campus-level)		
	<p>Course Objectives (CObs):</p> <ul style="list-style-type: none"> • To make students aware about human rights and human values. 	
Unit 1	<p>Introduction to Human Rights</p> <p>1.1 Concept of Human Rights 1.2 Nature and Scope of Human Rights 1.3 Fundamental Rights and Fundamental Duties 1.4 Interrelation of Rights and Duties</p>	6 hrs.
Unit 2	<p>Human Rights in India</p> <p>2.1 Meaning and Significance of : 1) Right to Equality 2) Right to Freedom, 3) Right against Exploitation, 4) Right to Freedom of Religion, 5) Cultural and Educational Rights, and 6) Right to Constitutional Remedies. 2.2 Constitutional Provisions for Human Rights 2.3 Declaration of Human Rights 2.4: National Human Rights Commission</p>	8 hrs.
Unit 3	<p>Human Values</p> <p>3.1: Meaning and Definitions of Values 3.2: Importance of values in the life of Individual 3.3: Types of Values 3.4: Programmes for conservation of Values</p>	8 hrs.
Unit 4	<p>Status of Social and Economically Disadvantaged people and their rights</p> <p>: Rights of women and children in the context of Social status : The Minorities and Human Rights : Status of SC/ST and other Indigenous People in the Indian Scenario 4.4: Human rights of economically disadvantaged Society</p>	8 hrs.
<p>Suggested readings:</p> <ol style="list-style-type: none"> 1. Human rights education – YCMOU, Nasik 2. Value education – SCERT, Pune 3. Human rights reference handbook – Lucille whare 		

Course Outcomes (COs):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC401A.1	Practice the learned issues under human rights and human values in real life.	3
AC401A.2	Provide social justices to people around them and provide guidance about human rights to their friends, parents and relatives.	5

AC-401(B): Current Affairs (Professional and Social + Value Added Audit course; Practical; 2 Credits) (Optional: Campus-level)			
Course Objectives (CObs): <ul style="list-style-type: none"> To make students updated about current affairs of India and world. 			
	Title	Content	Hours
Unit 1	Politics & Economy	<ul style="list-style-type: none"> National & International Political Activity, Organization. Economy & Business, Corporate world 	08
Unit 2	Awards and recognitions	<ul style="list-style-type: none"> National & International Awards and recognitions Books and authors 	07
Unit 3	Science & Technology	<ul style="list-style-type: none"> Software, Automobile, Space Research New inventions and discoveries 	07
Unit 4	Environment & Sports	<ul style="list-style-type: none"> Summit & conference, Ecology & Climate, Organization. National & International Games, Olympics, commonwealth etc. 	08
Suggested readings (Use recent years' data and current literature): 1. India 2019, by Publications Division Government of India 2. Manorama Year Book by Philip Mathew, 3. India 2019, Rajiv Maharshi 4. Quick General Knowledge 2018 with Current Affairs Update, Disha Experts 5. General Knowledge 2018: Latest Who's Who & Current Affairs by RPH Editorial Board.			

Course Outcomes (COts):

On completion of this course, the student will be able to:

COt No.	Course Outcomes	Cognitive level
AC401B.1	Identify important issues currently/ recently happening in India or world.	5
AC401B.2	Summarize current affairs regularly.	6

AC-401(C): GREEN AUDIT (Professional and Social + Value Added Audit course; Practical; 2 Credits) (Optional: Campus-level)	
Course Objectives (CObs): 1. To conduct the Green/Environmental Audit of given educational Institute/ Industry and submit the report.	
CONTENT OF THE SYLLABUS	
1.	Green audit; Scope, applicability and objectives.
2.	Procedure of conducting green audit.
3.	Water, raw material and energy balance.
4.	Hazardous waste audit
5.	ASSIGNMENT: Assignment to students for conducting Green/Environmental audit of educational institutes/industries.

Course Outcomes (COs):

On completion of this course, it is expected that:

Cot No.	Course Outcomes	Cognitive level
AC401C.1	Understand importance of Green Audit	2
AC401C.2	Determine environmental performance of educational Institute/ Industry, management systems and equipments.	6

AC-401(D): WATERSHED MANAGEMENT (Professional and Social + Value Added Audit course; Practical; 2 Credits) (Optional: Campus-level)	
<i>Course Objectives (Cobs):</i> 1. To make students aware about the concept of watershed management.	
CONTENT OF THE SYLLABUS	
1.	Fundamental of Watershed Management
2.	Elements of Hydrology
3.	Soil and Water Conservation
4.	Rainfed Farming
5.	Funding, Monitoring, Evaluation and Capacity Building
6.	Project Formulation
7.	ASSIGNMENT: Seminar and Review articles for promoting and spreading awareness about watershed management.

Course Outcomes (Cots):

On completion of this course, the student will be able to:

Cot No.	Course Outcomes	Cognitive level
AC401D.1	Practice learned on field affecting watershed management.	3
AC401D.2	Provide awareness about importance of watershed management to local community	2
