

## **Punyashlok Ahilyadevi Holkar Solapur University, Solapur**



**Name of the Faculty: Science & Technology**

**CHOICE BASED CREDIT SYSTEM**

**Syllabus: ENVIRONMENTAL SCIENCE**

**Name of the Course: M.Sc. I (Semester – I & II)**

**(Syllabus to be implemented w.e.f. June 2020)**

## Punyashlok Ahilyadevi Holkar Solapur University, Solapur

### Syllabus of M.Sc. I - Environmental Science

- 1) **Title of the course:** M.Sc. (Environmental Science).
- 2) **Duration of course:** Two years.
- 3) **Pattern:** Semester and Credit system.
- 4) **Eligibility:** B.Sc in (Any Subject) / B.Sc Agriculture / Biotechnology / Bio-Chemistry/Entrepreneurship.
- 5) **Strength of the Students:** 24 Intake Capacity

M.Sc. program in Environmental Science consists of 100 credits. Credits of a course are specified against the title of the course.

#### A Four Semester M.Sc. Environmental Science Course

Semester	No. of Papers/ Practicals / Seminar	Marks	Credits
<b>Semester I</b> • Theory Papers • Practical Paper • Seminar/Test/Assignment /Field Tour/ Industrial Visit	04	400	16
	04	200	08
	01	25	01
<b>Semester II</b> • Theory Papers • Practical Paper • Seminar/Test/ Assignment /Field Tour/ Industrial Visit	04	400	16
	04	200	08
	01	25	01
<b>Semester III</b> • Theory papers • Practical Paper • Seminar/Test/Assignment /Field Tour/ Industrial Visit	04	400	16
	04	200	08
	01	25	01
<b>Semester IV</b> • Theory papers • Practical Paper • Seminar/Test/ Assignment /Field Tour/ Industrial Visit	04	400	16
	04	200	08
	01	25	01
<b>Total marks and credits for M.Sc. Course</b>	<b>2500</b>		<b>100</b>

**M.Sc Environmental Science (CBCS - Syllabus) - 2020**

Semester	Code	Title of The Paper	Semester Exam			L	T	P	Credits
			Theory	IA	Total				
<b>First</b>	<b>-</b>	<b>Hard Core</b>							
EST	HCT1.1	Fundamentals of Environmental Science	70	30	100	4			4
	HCT1.2	Environmental Chemistry & Instrumentation	70	30	100	4			4
	HCT1.3	Computer Applications in Environmental Science	70	30	100	4			4
		<b>Soft Core (any One)</b>							
	SCT1.1	Environmental Geo-Climate	70	30	100	4			4
	SCT1.2	Geomorphology	70	30	100	4			
		<b>Practical (Hard Core)</b>							
	HCP1.1	Practical HCP1.1	35	15	50			2	6
	HCP1.2	Practical HCP1.2	35	15	50			2	
	HCP1.3	Practical HCP1.3	35	15	50			2	
		<b>Practical Soft Core (Any One)</b>							
	SCP1.1	Practical SCP1.1	35	15	50			2	2
	SCP1.2	Practical SCP1.2	35	15	50			2	
		Soft skill ICT, Scientific English, Industrial / Field Visits			25		01		1
		<b>Total Marks for First Semester</b>	<b>420</b>	<b>180</b>	<b>625</b>				<b>25</b>
<b>Second</b>		<b>Hard Core</b>	<b>Theory</b>	<b>IA</b>	<b>Total</b>				
EST	HCT2.1	Biodiversity and Conservation	70	30	100	4			4
	HCT2.2	Water and wastewater Engineering	70	30	100	4			4
		<b>Soft Core (any One)</b>							
	SCT2.1	Remote Sensing, GIS, GPS in Environmental Science	70	30	100	4			4
	SCT2.2	Industrial Safety, Health and Environment	70	30	100	4			
		<b>Open Elective (Any One)</b>							
	OET2.1	Environmental Geography	70	30	100	4			4
	OET2.2	Hydrology & Watershed Management	70	30	100	4			
		<b>Practical (Hard Core)</b>							
	HCP2.1	Practical HCP2.1	35	15	50			2	4

	HCP2.2	Practical HCP2.2	35	15	50			2	
		<b>Practical (Soft Core) (any one)</b>							
	SCP2.1	Practical SCP2.1	35	15	50			2	2
	SCP2.2	Practical SCP2.2	35	15	50			2	
		<b>Practical Open Elective (any one)</b>							
	OEP2.1	Practical OEP2.1	35	15	50			2	2
	OEP2.2	Practical OEP2.2	35	15	50			2	
		Soft skill ICT, / Industrial visit/ Field Tour and Tour report			25		01		1
		<b>Total Marks for Second Semester</b>	<b>420</b>	<b>180</b>	<b>625</b>				<b>25</b>

**Compulsory: \*Field work / Study Tour/ Industrial visits of 10-15 days are compulsory. The field work may be stretch or divided into parts in the academic year**

Third		Hard Core	Theory	IA	Total				
EST	HCT3.1	Environmental pollution, monitoring and control	70	30	100	4			4
	HCT3.2	Environmental Microbiology, Biotechnology & Nanotechnology	70	30	100	4			4
		<b>Soft Core (any One)</b>							
	SCT3.1	Statistical Methods in Earth & Environmental Science	70	30	100	4			4
	SCT3.2	Research methods in Environmental Science	70	30	100	4			
		<b>Open Elective (Any One)</b>							
	OET3.1	Natural Resources Management	70	30	100	4			4
	OET3.2	Ecotourism	70	30	100	4			
		<b>Practical (Hard Core)</b>							
	HCP3.1	Practical HCP3.1	35	15	50			2	4
	HCP3.2	Practical HCP3.2	35	15	50			2	
		<b>Practical (Soft Core) (any one)</b>							
	SCP3.1	Practical SCP3.1	35	15	50			2	2
	SCP3.2	Practical SCP3.2	35	15	50			2	
		<b>Practical Open Elective(any one)</b>							
	OEP3.1	Practical OEP3.1	35	15	50			2	2
	OEP3.2	Practical OEP3.2	35	15	50			2	
		One month Summer / Winter Training at Industries / Research			25		01		1

		Institutes/Consultancies / NGO. Presentation on training & report Submission							
		<b>Total Marks for Third Semester</b>	<b>420</b>	<b>180</b>	<b>625</b>				<b>25</b>
<b>Fourth</b>		<b>Hard Core</b>	<b>Theory</b>	<b>IA</b>	<b>Total</b>				
EST	HCT4.1	Environmental Virology, toxicology and Bio-safety	70	30	100	4			4
	HCT4.2	Environmental policy, Acts, and Environmental Management System	70	30	100	4			4
	HCT4.3	Environmental Impact Assessment and Environmental Audit	70	30	100	4			4
		<b>Soft Core (any One)</b>							
	SCT4.1	Dissertation	70	30	100	4			4
	SCT4.2	Hazards and Disaster Management	70	30	100	4			
		<b>Practical (Hard Core)</b>							
	HCP4.1	Practical HCP4.1	35	15	50			2	6
	HCP4.2	Practical HCP4.2	35	15	50			2	
	HCP4.3	Practical HCP4.3	35	15	50			2	
		<b>Soft Core (Any One)</b>							
	SCP4.1	Practical SCP4.1	35	15	50			2	2
	SCP4.2	Practical SCP4.2	35	15	50			2	
		Soft skill ICT, Scientific English Study Tour and Tour report submission & Presentation			25		01		1
		<b>Total Marks for Fourth Semester</b>	<b>420</b>	<b>180</b>	<b>625</b>				<b>25</b>
<b>Compulsory: *Field work / Study Tour/ Industrial visits of 10-15 days are compulsory. The field work may be stretch or divided into parts in the academic year</b>									

**N.B.:** Each semester will have 1 credit (25 marks) for- field training for long tour, industrial training/remote sensing institute, scientific institutes visit and their visit reports or field work and report data acquisition related to dissertation.

**HCT=Hard Core Theory**

**OET=Open Elective Theory**

**L=Lecture**

**HCP=Hard Core Practical**

**IA=Internal Assessment**

**T=Tutorials**

**SCT=Soft Core Theory**

**P=Practical**

**Evaluation Scheme:**

Each theory paper will have 100 marks out of which 70 marks will be for Term End examination and 30 marks for Internal Assessment. The candidate has to appear for internal evaluation of 30 marks and external evaluation (University Examination) of 70 marks for each theory paper. Each practical paper will have 50 marks out of which 35 marks will be for Term End examination and 15 marks for Internal Assessment. The candidate has to appear for internal evaluation of 15 marks and external evaluation (University Examination) of 35 marks for each practical paper.

**A) Internal Evaluation:**

- In case of theory papers internal examinations will be conducted by department / school. Marks for internal assessment shall be awarded on the basis of seminars, filed work, industrial visit, assignments, internal test etc
- In case of practical papers, 5 marks shall be for day-to-day journal, 5 marks for test / viva-voce, 05 marks for attendance, which will be conducted by the department / school.

<b>Theory (Each Paper)</b>	<b>Total marks 30</b>
Internal Test	10
Seminar	05
Assignment	05
Field / Industrial Visit	05
Students Attendance	05

<b>Practical (Each Part / paper)</b>	<b>Total marks 15</b>
Test	05
Journal / Record book	05
Students Attendance	05
<b>Total Internal Assessment Practical papers for each semester (02 Papers)</b>	<b>30</b>

**B) External Evaluation (End of Term University Examination):**

**I) Nature of Theory question paper:**

- 1) Each Theory paper is of 70 marks.
- 2) Each Theory paper will be of 2 hours and 30 minutes duration
- 3) There shall be 5 questions each carrying 14 marks.
- 4) Students have to attempt all the questions.

**II) Nature of Practical question paper: (End of Term Examination)**

Practical examination will be conducted for 30 marks and is of two hours duration. There shall be 05 questions each of 10 marks, of which student has to attempt any 03 questions. VIVA will be for 5 marks. Practical will be Total 35marks.

**M.Sc. Environmental Science, Part I, Semester – I (CBCS Syllabus) - w.e.f. June 2020**

**EST- HCT 1.1: Fundamentals of Environmental Science**

**External Marks 70**

**Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Introduction of Environment &amp; Environmental Science:</b> Definition, background, principles, scope and interdisciplinary nature of Environmental Science, objectives of environmental science; concept on environment; Environmental history Timeline- incidents or events that brought about changes towards the perspective of environmental study, World Environment Day and National Earth Day and their relevance; Environmental Science and technology, Media and people, decision making and applications of Environmental Science.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Environmental awareness and Environmental issues:</b> Environmental awareness and education, Environmental education rules and policies in India, environmental days or calendar, Environmental movements in India (Narmada Dam, Sardar Sarovar Project, Tehri Dam, Chipko movement, Silent Valley Project). Environmental issues (Global and National Environmental issues), Overpopulation, Natural resources depletion, Pollution, Greenhouse effect, Acid rain, Global Warming, Ozone Depletion, El Nino & ENSO, Tsunami, Ocean acidification, Sea level rise, Climate change, Acid rain, Urban sprawl, Deforestation, Biodiversity loss, Desertification, Public and occupational health issues (Epidemics, Endemics, Pandemic diseases).	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Environmental Segments and Consequences:</b> Environmental Segments or components, Lithosphere, hydrosphere, atmosphere and biosphere; physical and biological environments; Hunting and gathering, Tribal and nature, agriculture societies, industrial societies, impact of cultural change on environment, population explosion, degradation of natural resources, pollution of air, water and soil, urbanization, industrialization, water crises and energy crises.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Concept of carrying capacity and Sustainable Development:</b> Biotic and abiotic components of environment, concept of sustainability and carrying capacity, tragedy of commons, human population and food, water and energy security, present status of environment and future scenarios, Growth and Development, Life Processes and characteristics, Basic ideas with respects to growth, metabolism and developmental processes, Definition, history and background of sustainable development, Sustainable Development Goals and role of youth in the Sustainable Development.	<b>1</b>	<b>14</b>

**Practical HCP 1.1 based on HCT 1.1: Fundamentals of Environmental Science**

**External Marks 35**

**Internal Marks 15**

1. Identification of common weeds, Herbarium preparation
2. Biodiversity categorization and measurement studies.
3. A visit to aquatic ecosystem and methods for water and plankton collection,
4. Plankton identification and quantification from river / lake water samples,
5. Vegetation studies by line, Quadrates and belt transect methods and their analysis.
6. Qualitative and quantitative estimation of Phytoplankton.
7. Estimation of Primary Productivity by light and dark bottle method.
8. Estimation of primary productivity of grasses by Harvest method.

**Recommended Books:**

1. Environmental Science, Trivedi R.N. 1st Edition, Anmol Publication Pvt. Ltd. Delhi.
2. Environmental Science, Cunningham W.P. and Cunningham, M. A. Tata Mc. Graw – Hill Publication Co Ltd. Delhi.
3. Environmental Science, Jackson A.R.W. and Jackson J.M. 1st Edition, (Longman, Group) British Library Cataloguing.
4. Introduction to Environmental Science, Anjaneyulu, Y. B.S. Publication. New. Delhi
5. Environmental Science, Wright R. T. 9th Edition, Pearson Education Inc.
6. Environmental Science Principle and Practice, Das R.C. and Behera B.K. Prentice Hall of India Pvt. Ltd, Delhi.
7. An Introduction to sustainable development, Rogers P.P., Jalal KF and Boyd J.A , Earth Scan
8. Environmental Sciences, Daniel Botkin and Edward Keller, John Wiley and Sons, New York (1997)
9. Environmental Science, Eldon D. Enger and Bradley F. Smith, WCB Publishers, Boston (1995).
10. Principles of Environmental Science-Watt, K. E. F. (1973) McGraw-Hill Book Company.
11. Environmental Science –Noble, B .J. Kormandy, E.J.(1981),The way world works, Prentice-Hall Inc.N .J.
12. Environmental Science-Turk A. , Turk J. Wittes J.T. and Wittes, R.E.
13. Environmental Issues: Measuring, Analyzing, Evaluating, Abel, Daniel C. McConnell, Robert L. Abel, Daniel C. Edi. 2 Prentice Hall Publication
14. Environmental Science — S. C. Santra, New Central Book Agency.



**EST –HCT 1.2: Environmental Chemistry and Instrumentation****External Marks 70****Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Concept and scope of Environmental Chemistry:</b> Concept and scope of environmental chemistry, Chemistry of environmental segments - lithosphere, hydrosphere, atmosphere. Basic concepts of Environmental Chemistry: elements, valency, molecular weight, equivalent weight, mole, normality, molarity, molality, molar solution, standardization or standard solution, titration, Nernst distribution law, Energy & forms of energy; laws of thermodynamics (First & Second), Gibbs energy, stoichiometry, colloidal chemistry, emulsions, adsorption, absorption, chemical reactions, chemical potential, chemical equilibrium, acid-base reactions, solubility product; unsaturated and saturated hydrocarbons.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>a) Atmospheric Chemistry:</b> Chemical composition of air, Classification of elements, chemical speciation. Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter. Thermo-chemical and photochemical reactions in the atmosphere. CFC's and Ozone chemistry, chemistry of air pollutants, photochemical smog. <b>b) Water Chemistry:</b> Structure and properties of water, water pollutants- types, sources, heavy metals metalloids-organic, biological and radioactive- types of reactions in various water bodies including marine environment. Chemistry of oil based and water based paints, physicochemical basis of redox processes. Electrochemical theory of corrosion. <b>c) Soil Chemistry:</b> Soil profile, distribution of inorganic and organic components in soil, Chemical properties of Soil - Saline, Acidic and Alkaline soils. Major micro and macro nutrients of soil, Nutrient Pathways - Nitrogen, Phosphorus and Potassium pathways in the soil, adsorption of contaminants in soil, Effect of modern agro-technology on quality of soil.	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Toxic Chemicals in the Environment and monitoring methods:</b> Organic and inorganic chemicals and their reactions in the environment, soaps, detergents, polymers, drugs, dyes, oil and grease, Inorganic chemicals in the environment, Inorganic gaseous pollutants, Particulate matter, trace leave toxic metals, Inorganic pesticides, Persistent organic pesticides and fertilizers. Sampling of air and water pollutants, Monitoring techniques and methodology, pH, Dissolved Oxygen (DO), Chemical oxygen demand (COD), Biological Oxygen Demand (BOD), analysis of metals, monitoring and analysis of CO, NO <sub>x</sub> , CO <sub>2</sub> , SO <sub>x</sub> and PM.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Instrumentation or Analytical Techniques for Environmental Monitoring:</b> Theoretical principles of Analytical Techniques – Role and importance of analytical techniques in analysis of environmental samples. Titrimetry; types and applications of neutralization, precipitation, complexometric titrations; gravimetry, Conductometry, pH, Colorimetry, Spectrometry,	<b>1</b>	<b>14</b>

UV-Vis and IR Spectrophotometer and AAS. Nephelometry, Flame Spectrometry and fluorimetry; Chromatographic techniques: Paper, Thin Layer, GC and Gas – Liquid Chromatography, HPLC, X-ray fluorescence, X-ray diffraction, NMR, Elemental analyzer, HVS, Particulates & Gases Sampler and Electrophoresis.		
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### Practical HCP 1.2 based on HCT 1.2: Environmental Chemistry and Instrumentation

#### External Marks 35

#### Internal Marks 15

- 1) Study of Sampling and storage techniques of Air, Water and Soil samples
- 2) Determination of pH and Electrical conductivity (EC) calibration and metric titration of soil and water
- 3) Determination of Dissolved Oxygen (DO) by Winkler's method.
- 4) Determination of Biochemical Oxygen Demand (BOD)
- 5) Determination of Chemical Oxygen Demand (COD)
- 6) Determination of Solids (TDS, TSS and TS)
- 7) Determination of Hardness (Ca, Mg and Total Hardness)
- 8) Determination of Alkalinity and Acidity
- 9) Principal, Working , demonstration and applications of flame photometer, Turbidity meter, Colorimeter and HVS / AFD ambient sampler
- 10) Visit to Central Facility Centre (XRD, XRF, NMR, AAS, GC-MS and UV spectrophotometer).

#### Recommended Books:

1. Sharma B.K and Kaur H. (1995). Environmental Chemistry, I Ed., Goel Publishing House.
2. De A.K (1989). Environmental Chemistry, II Ed., Wiley Eastern Limited.
3. Bailey, R.A. (1978). Chemistry of the Environment, Academic Press.
4. Tyagi O.D. and Mehra M. (1990). Text Book of Environmental Chemistry, I Ed., Anmol Publications.
5. Charles R. Goldman and Alexander J. Horene. (1983). Limnology, McGraw- Hill.
6. Roy L. Donahue, Raymond W. Miller and John C. Shickluna. (1987). Soils An Introduction to soils and plant growth V.Ed., Prentice-Hall of India.
7. Biswas T.D and Mukherjee S.K. (1987). Text book of Soil Science IV Ed., Mc Graw- Hill.
8. Vogel's Textbook of Quantitative Inorganic Analysis. (1978). IV Ed., Longman Group Ltd.
9. Jacobs. (1969). Analytical Chemistry of Industrial poisons. Hazards and solvents, M.B. Inter Science. New York.
10. Hobert H. Willard D.L. Merrit and J. R. J. A. Dean, Fundamentals of Analytical Chemistry, 1982.
11. Tyagi O.D. and Mehra M. (1990). Environmental Chemistry, Anmol Publications.
12. Manahan S.E. (2000). Environmental Chemistry (7th Ed), Lewis Publications, Florida, U.S.A.
13. Lave, L.B and Upton, A.C. Toxic Chemicals, health and the Environment, 1987. The Hopkins Press Ltd., London.
14. Chatwal and Anand, Instrumental Methods of analysis

**EST- HCT 1.3: Computer Applications in Environmental Sciences**

**External Marks 70**

**Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>History and Basics of computers:</b> An introduction to computers, development of computers, Hardware and Software. Types of Hardware and software's, Fundamentals of computers – Operating systems, Input to the computers, central processing unit, Computer output, Storage devices, Compact Disk Cartridges, pen drives, memory card, hard discs and other advanced storage devices & uses.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Personal Computers and IT:</b> Data communication and networks – Application software, word processing, spread sheets, Data management and graphics. Data Base Management System, Multimedia. General Idea about the networking, LAN, WAN, databases, etc. Use of information technology in environmental studies, Definition, scope of information technology, history and present status of information technology, application of IT in environmental protection.	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Introduction to MS and Google Applications – EXCEL,</b> Power point, Word and worksheet to enter data, edit data, copy data, move data. Use of excel for computations of various statistical constraints, use of charts, Introduction to MS-Word, word processor, editing, coping, moving, formatting, table, insertion, etc. Use of standard software's for representing various data in graphs, diagrams, charts etc. Email Account, Google Classroom, Google Docs, Google sheets, Google slides, Google books, blogger, hangouts, and Google Drives applications in Environmental Science.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Computer applications, technology in environmental sciences:</b> Introduction to Bio informatics – scope, tools and applications. Application of Computer in Earth Sciences - Geoinformatics, Geology, Geography, hydrology, Environment or in thematic map preparation and modeling, Website Design. Concept of ICT, MOOCS, SWAYAM, NPTEL, E-Teaching and learning methods, Webinars, e- conferences, MOODLE, applications of meeting apps in Environment – ZOOM, Youtube, Skype, Duo, Webex Microsoft Teams etc and use of Mobile computing Apps for the Environmental studies.	<b>1</b>	<b>14</b>

**Practical HCP 1.3 based on HCT 1.3: Computer Applications in Environmental Science**

**External Marks 35**

**Internal Marks 15**

- 1) Use of Data sheet and data management in Environmental research work
- 2) Create Google Account and demonstrate various Google Applications for Data collection, data formulation, Quiz, form generation (Google Classroom, Google forms, Google Drives, Google Docs, and Google slides)
- 3) Demonstrate create Self QUIZ or feedback form for Environmental studies through Google forms
- 4) Demonstrate create and join Google class for environmental study

- 5) Demonstration and use different tools -
  - a) MS Word - Sample Biodata, Article writing
  - b) PowerPoint: PPT on Environmental topic
  - c) Excel: Data Collection, Analysis and representation with basics of Statistics (Pollution studies, Wildlife Census studies, Health studies etc)  
For Environmental Scientific data representation in the Computer Applications
- 6) Demonstrate use of Internet or Search various search engines for research projects or writing of research articles e.g. Google, Scopus, Web of Science, Google Scholar, Research gate, Academia etc
- 7) Demonstrate Creation of own YouTube Channel by using various tools for Environmental Education and research.
- 8) Demonstrate use of social meeting apps for Environmental Education Zoom, Webex, Skype, Microsoft Teams, Duo etc

**Recommended Books:**

1. Computer Fundamentals” by P K Sinha
2. Fundamentals of Natural Computing: Basic Concepts, Algorithms, and Applications (Chapman & Hall/CRC Computer and Information Science Series)” by de Castro and Leandro Nunes
3. Fundamentals of Computers” by Rajaraman V and Adabala N
4. Computer Fundamentals and Programming in C” by Reema Thareja
5. Computer Fundamentals” by P K Sinha.
6. Computer Applications in the Earth Sciences by Merriam, Daniel (Ed.)
7. Fundamentals of Structural Analysis: With Computer Analysis and Applications” by Subrata Chakarabarty
8. Mathematical Models of Sedimentary Processes: An International Symposium (Computer Applications in the Earth Sciences)” by D Merriam
9. Mathematical Methods in the Earth and Environmental Sciences by Adrian Burd, University of Georgia
10. PRATICAL INTRODUCTION TO COMPUTER APPLICATIONS AND MAINTENANCE GUIDELINES by James E Collins
11. Computer Concepts AND Microsoft Office 365 for 2019 Text by SEGUIN | Apr 30, 2019
12. Computer Vision: Principles, Algorithms, Applications, Learning by E. R. Davies

**EST – SCT 1.1: Environmental Geo-Climate**

**External Marks 70**

**Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Introduction to Environmental Geo-science</b> Environmental Geo-science: Fundamental concepts, Primary differentiation and formation of core, mantle, crust, magma generation, eruptions and volcanoes. Formation and classification of rocks: plate tectonics – sea floor spreading, mountain formation, rock deformation and evolution of continents, weathering and soil formation, Rock Cycle.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Environmental Geochemistry</b> Concept of major, minor and trace elements. Mobility of elements, geochemical cycles, sedimentary cycle, deforestation and erosion, Geo-indicators, geological consequences of industrialization, groundwater pollution and management-case studies related to fluoride, pesticide, fertilizers and arsenic contaminations in India, Mineral resources in relation to plate tectonics and geology, geology of mineral resources, mineral sources and reserves, distribution of mineral resources in India. Environmental impact of exploitation, processing and smelting of minerals.	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Atmosphere</b> Radiation, conduction and convection, forms of condensation- dew, frost, fog, mist, smog and cloud, Atmospheric stability, adiabatic character, dry and wet adiabatic lapse rate, Turbulence and diffusion, Different layers and their characteristics, meteorological aspects- inversions, mixing height, wind-rose, electromagnetic radiations, solar radiation and terrestrial radiation, heat budget, Temperature measurements and controls, Environmental lapse rate, humidity, mixing ratio.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Environmental Climatology</b> Elements of Weather and Climate, classification, energy balance in atmosphere, greenhouse effect, Geo-strophic wind and gradient wind, cyclones, Forms of cloud condensation; Precipitation, Thunderstorms, floods and droughts, Acid rain, Effects of acid rain on environmental components, drinking water standard, introduction to weather forecasting models.	<b>1</b>	<b>14</b>

**Practical SCP 1.1 based on SCT 1.1: Environmental Geo-Climate**

**External Marks 35**

**Internal Marks 15**

1. Preparation of Global and Indian natural hazard maps
2. Interpretation of transport of pollutants in the subsurface
3. Preparation of local level maps of pollution case studies
4. Preparation of groundwater flow nets and assessment of probable contaminant movement in the subsurface
5. Problem solving on movement of pollutants in the subsurface using simple computer assisted models
6. Study of Geomorphological models: a) Coastal plain b) Volcanoes c) Fault blocks mountains d) Folded mountains e) Glaciers f) Canyon g) Cost line

7. Petrology: Identification of major rock types
8. Mineralogy: Identification of common rock forming minerals
8. Study of the conventional signs and symbols from Toposheet and their interpretation
9. Study of the conventional signs and symbols from weather map and interpretation of weather map.

**Recommended Books:**

1. A.N. Strahler and A.H. Strahler (1973), Environmental Geo-science-Hamilton Publication
2. Basu S.K. (2003), Handbook of Oceanography, Global Vision, Delhi.
3. Bell F. G., (1998), Environmental geology: Principles and practice. Blackwell Sc. Oxford.
4. Bennett, M. R. and Doyle, P. (1997), Environmental geology - Geology and the Human Environment. John Wiley and Sons.
5. Botkin, Daniel B. and Keller, Edward A (2007), Environmental Science: Earth as a Living Planet. 6th ed. John Wiley & Sons, USA.
6. Bouwer, H. (1978), Groundwater Hydrology. McGraw-Hill, New York.
7. Butz, S.D. (2004), Science of Earth Systems. 2nd ed. Thomson Delmar Learning, USA
8. Chamley, H. and Chamley, H. (2003), Geosciences, Environment and Man Elsevier Science & Technology pub.
9. Chiras,D.D (1989), Environmental Science-A frame work for decision maling- Addison-Wesley publishing company- New York.

**EST – SCT 1.2: Geomorphology**

**External Marks 70**

**Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Concepts and Approaches:</b> Fundamental Concepts, Concepts of time: cyclic, graded and steady state, concept of morphogenetic regions, concept of dynamic equilibrium, approaches in geomorphology, recent trends in geomorphology	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Geomorphic Processes and Landforms:</b> Earth movements, Plate Tectonic and Sea floor Spreading, Weathering and Mass Movements, Dynamics of fluvial, glacial, aeolian, marine, and karst processes; Landforms: Climatic, Tectonic, Erosional and depositional Landforms	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Theories and Techniques:</b> Theories of Hill slope evolution, Erosion surfaces; Systems in geomorphology; Models in geomorphology Climatic Geomorphology and Earth Movement, Climate & land form, humid, sub-humid, arid & semi-arid nature of weathering Continental drift theory & concept plate tectonic theory, crustal movements.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Applied Geomorphology:</b> Nature and objectives, geomorphic hazards and mitigation measures, Application of geomorphological knowledge in mining, constructions and other human activities, Settlement, Construction (dam, road, building, tunnel etc.), Disaster management.	<b>1</b>	<b>14</b>

**Practical SCP 1.2 based on SCT 1.2: Geomorphology**

**External Marks 35**

**Internal Marks 15**

1. Toposheet Interpretation: Basic information on Topographical sheets, Preliminary information, Conventional Signs, Interpretation of Relief, Drainage, Settlements, Landuse, Vegetation and Transport network on Toposheets (at least 12 Exercises).
2. Natural and Human resources: Water, Forest, Minerals, Soil, Transportation, settlement, agriculture, industries, education facility, cultural places, population
3. Morphometric Analysis of Drainage basin- its geographical significance; Basin morphometry of fluvially originated drainage basin Linear Aspects: Stream ordering based on Horton and Strahler, Bifurcation ratio
4. Areal Aspects: Geometry of basin shape, Basin Perimeter, Length and Area, Stream frequency and Drainage density. Relief Aspects:
5. Hypsometric analysis- Hypsometric curve and Integral Hypsometric curve, Clinographic analysis, Altimetric analysis, Slope Analysis- Average Slope (Wentworth's method), Relative Relief (Smith's method), Dissection Index, Profile Analysis - Longitudinal profile

6. Quantitative methods: Semi average method, leastsqare method, exponential growth rateof population, lorenze curve, rank size rule, nearest neighbor techniques, nelson methods of town classification, accessibility of transport network, crop combination method
7. Climatic data: Interpretation of Indian daily weather report
8. Wind Rose diagram, Line Graph, Dispersion diagram

**Recommended Books:**

1. Pitty, A.F. (1971): Introduction to Geomorphology, Methuen, London.
2. Sharma, H.S. (ed.) (1980): Perspectives in Geomorphology, Concept, New Delhi.
3. Singh, S. (1993): Physical Geography, Prayag Pustak Bhawan, Allahabad.
4. Singh, S. (1998): Geomorphology, Prayag Pustak Bhawan, Allahabad.
5. Skinner, B.J. & Porter, S.C. (1995): The Dynamic Earth, John Wiley, New York.
6. Sparks, B.W. (1960): Geomorphology, Longman, London.
7. Stoddart, D.R. (ed.) (1996): Process and Form in Geomorphology, Routledge, New York.
8. Bloom, A.L. (1992): Geomorphology, Second Edition, Prentice Hall of India, New Delhi.
9. Chorley, R.J. (1972): Spatial Analysis in Geomorphology, Methuen, London.
10. Cooke, R.U. and Doornkamp, J.C. (1974): Geomorphology in Environmental Management—An Introduction, Clarendon Press, Oxford.
11. Dayal, P. (1990): A Text Book of Geomorphology, Shukla Book Depot, Patna.
12. Dury, G.H. (1959): The Face of the Earth, Penguin, Harmondsworth.
13. Fairbridge, R.W. (1968): Encyclopedia of Geomorphology, Reinholdts, New York.
14. Husain, M. (2002): Fundamentals of Physical Geography, Second Edition, Rawat Publications, Jaipur.
15. McKnight, T. L. (1987): Physical Geography: A Landscape Appreciation, Second Edition, Prentice Hall, New Jersey.
16. Olliver, C.D. (1979): Weathering, Longman, London.



**M.Sc. Environmental Science, Part I, Semester – II (CBCS Syllabus) - w.e.f. June 2020**

**EST- HCT 2.1: Biodiversity and Conservation**

**External Marks 70**

**Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Introduction to Biodiversity</b> Level of biological organization, the global perspective, Global Environmental changes, Bio-geographical regions of India, Biodiversity concepts and patterns, Microbial diversity, Plant diversity, Agro-biodiversity, Soil biodiversity. Types: Species diversity, Genetic diversity, Pattern diversity, Alpha, Beta and Gama diversity, Gradients of Biodiversity, Ecosystem diversity, Measuring of species diversity, richness and evenness, factors related to tropical species diversity.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Factors governing biodiversity</b> Biodiversity hot-spots, diversity distribution, factors affecting diversity, Mega diversity regions of India, Diversity trends of different ecosystem, Major forest types and distribution of wild life in India. Impact of exotic species, disturbance on diversity, dispersal, diversity-stability relationship, keystone species.	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Conservation of Biodiversity</b> Threats to biodiversity, Human interference and habitat destruction, Human & Wildlife Conflicts, biological invasion. Importance of biodiversity conservation, direct and indirect benefits, Bioprospecting, Biopiracy, REDD. Strategies for biodiversity conservation. In-situ and ex-situ conservation, wildlife habitats and their conservation. Protected Area network, Biosphere Reserves, National Parks, sanctuaries, sacred groves; ex-situ conservation, gene pools, germ plasm banks.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Biodiversity Action Plan</b> International conventions on biodiversity, IUCN Criteria, endemic, extinct, endangered, vulnerable and rare species, Red Data Book. National Policy and Action Plan, Role of Forest Department in Conservation, Biodiversity Legislation in India. Integrated Protected Area System, RAMSAR sites. Existing conservation projects: Tiger, Rhino, Elephant, Turtles, Crocodiles, coral reefs and Mangroves.	<b>1</b>	<b>14</b>

**Practical HCP 2.1 based on HCT 2.1: Biodiversity and Conservation**

**External Marks 35**

**Internal Marks 15**

1. Determination of phytoplankton diversity of a water body by Nygaard index.
2. Determination of population density of insects/birds/reptiles/mammals.
3. To observe the impact of invasive species on vegetation and species composition.
4. To study the impact of disturbance on vegetation.
5. Preparation of a list of herbicides / pesticides / insecticides commonly used in the area.
6. Estimation of Ecological indices:

- I. Index of diversity, richness
- II. Evenness and dominance of species.
7. Calculation of similarity & dissimilarity index between two adjoining communities.
8. Calculations of Niche overlap between two species.
9. Survey of local market for studying vegetable diversity.
10. Visit to plateaus, grasslands, forests to understand plant diversity.
11. Visit to local fish market for identification.

**Recommended Books:**

1. Simpson, G.G. (1949). *The meaning of evolution, A Study of the History of Life and of Its Significance for Man*. Oxford University Press.
2. Magguran, A.E. (1996). *Ecological diversity and its measurements*. Princeton University.
3. Gadgil, M. () *A methodology manual for scientific inventoring, monitoring and conservation of Biodiversity*.
4. Sutherland, W. (2006). *Ecological census technique: A Handbook, 2nd Edn*. Cambridge University Press.
5. Gadgil, M. et. al. *A Methodology Manual for Documenting People's Priorities for Biodiversity and Conservation. Shrustiygyaan*.
6. Malhotra, K.C. et. al. (2001). *Cultural and Ecological Dimensions of Sacred Groves in India*. INSA, New Delhi.
7. Gadgil, Madhav and Rao, P.R.S. *Nurturing Biodiversity: An Indian Agenda*. Centre for Environment Education, Ahmadabad, India. 1999.
8. Dobson, A.P., 1996, *Conservation and Biodiversity*. Scientific American Library, New York, NY.
9. Gaston, K J. and J.I. Spicer, 1998, *Biodiversity: An Introduction*. Blackwell Science, London, UK.
10. Loreau, M., and P. Inchausti, 2002, *Biodiversity and Ecosystem functioning: Synthesis and Perspectives*. Oxford University Press, Oxford, UK.
11. Primack, R.B., 2002, *Essentials of Conservation Biology*, 3rd Edn., Sinauer Associates, Sunderland, Ma. USA.
12. Hunter, Malcolm L., Jr., and Gibbs, James P. *Fundamentals of Conservation Biology*. 3rd ed. Wiley-Blackwell. 2006

**EST- HCT 2.2: Water and Wastewater Engineering**

**External Marks 70**

**Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Water and Methods of treatment</b> Water requirement or consumption - domestic, institution, firefighting, commercial, industrial and cultural places, consumption. Population forecasting for water & wastewater - demographic, arithmetical progression, geometrical progression and logistic method. Water Quality Standards for drinking and package drinking water- BIS, WHO. Methods and Concept of water treatment plant (WTP), Sewage treatment plant (STP), Effluent treatment plant (ETP), Common Effluent treatment plant (CETP) design aspects of major units in treatment plants and their functions.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Physical Treatment (Physico-Chemical)</b> Physical Unit operations and processes: Principles, applications and designing aspects of - Bar screen, grit chamber, barmunitors, skimming tanks Chemical Unit operations and processes: Principles, applications and designing aspects of - Coagulation and Sedimentation, flocculation, disinfection, clarifier.	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Biological Treatment</b> Aerobic treatment- Principles, applications and designing aspects of - Activated Sludge Process, Aerobic ponds, Oxidation ponds, Stabilization ponds. Anaerobic treatment- Principles, applications and designing aspects of - Trickling filter, Rotatory Biological Contactors (RBC's), Continuous Stirring Tank Reactor, UASB, septic tank, Imhoff tank, Constructed wetlands, Root Zone Bed Technology for waste water treatment.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Advanced treatment &amp; Sludge Management</b> Advance or Tertiary Treatment: Activated carbon filtration unit, PACT, disinfection of water -UV radiation, Ozonation, Chlorination, Water softening. Filtration- Micro-filtration, Ultra-filtration, Nano-filtration, Reverse Osmosis, Wet Air Oxidation, ion exchange, Membrane bioreactor. Discharge or management of treated wastewater: On land, on river and on ocean. Sludge Treatment - Bioremediation or green technologies used for sludge management: Composting, land filling, thickening, alkaline stabilization, Conditioning, incineration, Dewatering.	<b>1</b>	<b>14</b>

**Practical HCP 2.2 based on HCT 2.2: Water and Wastewater Engineering**

**External Marks 35**

**Internal Marks 15**

1. Draw and demonstrate Flow Chart / Diagram of ETP, STP, WTP and CETP with detailed explanation
2. Determine sludge volume index of given wastewater sample
3. Determine MLSS of given wastewater sample
4. Determine MLVSS of given wastewater sample
5. Determine oil and grease of given wastewater sample
6. Study of Jar test for wastewater treatment
7. Determine nitrate concentration in given wastewater sample
8. Determine phosphate in given wastewater sample
9. Determine sulphate in given wastewater sample.
10. Visits to industries ETP, Water Treatment Plant (WTP), Sewage Treatment Plant (STP) and Common Effluent Treatment Plant (CETP).

**Recommended Books:**

1. Wastewater Engineering: B.C.Punmia and Ashok Jain. Laxmi Publication N.Delhi
2. Water and Wastewater Engineering : G.S.Birdie and G.S.Birdie
3. Water and Wastewater Engineering Vol.I: Garg and Garg
4. Water and Wastewater Engineering: Metcalf and Eddy
5. Environmental Engineering: R.S.Gidde
6. Water and Wastewater Engineering: Arcivala
7. Water and Wastewater Engineering : Mackenzie L Devis WEF Publication
8. Principles of Foundation Engineering : Braja M.Das
9. Standard Handbook of Environmental Engineering 2nd Edi. Robert A.Corbitt

**EST- SCT 2.1: Remote Sensing, GIS, GPS in Environmental Science**

**External Marks 70**

**Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Fundamentals of Remote sensing</b> History & development, definition, concept and principles. Energy Resources, radiation principles, Electromagnetic radiation, interaction between matter and Electromagnetic radiation, Sensors: Types of sensors, concept of resolution – Spatial, Spectral, Temporal and Radiometric, Spectral Signatures. Basic concept and principles of thermal, microwave and hyperspectral sensing, spectral reflectance and their characteristics of Earth surface features.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Platforms and Photogrammetry</b> Products used in Remote sensing, Images, scale, mosaics, time and seasons of orbital cycles. Aerial photographs, photographic systems, Satellite data products. Photogrammetry - Basic principles, types, steps and elements of image interpretation, visual interpretation, and interpretation equipments - digital image processing - image rectification, enhancement, classification, data merging and biophysical modeling - image processing software. Satellites and their characteristics – Geo-stationary and sun-synchronous, Indian Space programmes.	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Introduction to GIS</b> Definition, History, Objectives of GIS, components of GIS, Application of GIS. Types of Geographical Data: Raster Data Model, Vector Data Model, GIS Tasks: Digitization, Input, Manipulation, Management, Query, Analysis and Visualization. Layer, Geographic Reference, Level of measurement: Nominal, Ordinal, Interval, Ratio. Concept of Topology, Arc, Node and Vertices, Connectivity, Containment, Contiguity. Remote Sensing Data Products and their procurement, GIS and spatial distribution of environmental data. GIS software's, Remote sensing and GIS applications - Management and monitoring of Environment, conservation of resources, natural resources, coastal zone management.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Concepts of GPS &amp; UAS</b> Spherical trigonometry, History, Types, Navigation Systems and Applications, Introduction to IRNSS. Concept of Unmanned Aircraft Systems (UAS), UAS are finding expanding commercial and public application across many industries including construction, agriculture, environmental monitoring, security, delivery, and more.	<b>1</b>	<b>14</b>

## Practical SCP 2.1 based on SCT 2.1: Remote Sensing, GIS, GPS in Environmental Science

### External Marks 35

### Internal Marks 15

1. Field Work- Identification of Features in the Field Using Aerial Photographs and/or Satellite Images
2. Aerial Photo and Image Interpretation: Interpretation of Aerial Photos: Single, Vertical Stereo Pairs.
3. Measurements: Geometry of Aerial Photographs, Determination of Scale, Parallax and height measurement
4. Overview of Arc GIS: Arc map, Arc catalog and Arc tool Box
5. Attribute Data Input: Creation Of Schema, Tables, Data Definition, Data Input, Data Updating, Queries on Tables, Simple-Complex Query With Two or More Tables Using SQL. Queries Using Union, Intersection, Join Etc Operations. Use of MS-Excel and MS Access
6. Spatial Data Input: Vector Data Formats With File Extensions. Scanning, On-Screen Digitization, Editing, Topology Creation, Line and Area Measurements, Data Attribution
7. Geodatabase in Arc catalog and Arc map: Feature Dataset, Feature Classes, Import of Data, Spatial Data Formats, Shape/Coverage Files and Layers, Data Frames, Maps, Managing TOC
8. Georeferencing Data: Coordinate Systems, Datum Conversions, Map Projections, Types, Storing- Viewing Projection Information
9. Working with Layers in Arc map: Building Templates, Classification, Displaying Qualitative and quantitative Values, Labeling Features and Map Creation.
10. Time-series data analysis
11. GPS: GPS Survey, Data Import, Processing and Mapping
12. Visit to Engineering colleges and Demonstrate working and applications of UAS in Environmental Science

### Recommended Books:

- 1) Joseph, G. (2004): Fundamentals of Remote Sensing, Universities Press, Hyderabad, India
- 2) Lillesand, T. M., Kiefer, R. W. and Chipman, J. W. (2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
- 3) Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
- 4) Campbell, J. (2002): Introduction to Remote Sensing, Taylor & Francis, London
- 5) Anji Reddy, M. (2008): Textbook of Remote Sensing and Geographic Information System, B.S. Publication, Hyderabad
- 6) Longley, P. A., Goodchild, M. F., Maguire, D. J., Rhind, D. W. (2002): Geographical Information Systems and Science, John Wiley & Sons, Chichester
- 7) Lo, C. P., Yeung, A. W. (2002): Concepts Techniques of Geographical Information Systems, Prentice Hall of India, New Delhi
- 8) Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
- 9) Korte, G. B. (2001): The GIS Book, Onward Press, Bangalore
- 10) Demers, M. N. (2000): Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi
- 11) Burrough, P. A. and McDonnell, R.A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
- 12) Heywood, I., Cornelius, S., Carver, S. (2011): An Introduction to Geographical Information Systems, Pearson Education, New Delhi
- 13) Ahmed, E. L. Rabbany (2002): Introduction to Global Positioning Systems, Artech House, Boston

**EST- SCT 2.2: Industrial Safety, Health and Environment****External Marks 70****Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Industrial Safety</b> History and development of safety movement, Need for safety, Safety legislation: Acts and rules, Safety standards and codes, Safety policy: safety organization and responsibilities and authorities of different levels. Accident sequence theory, Causes of accidents, Accident prevention and control techniques, Plant safety inspections, Job safety Analysis and investigation of accidents, First aid. Financial costs-direct and indirect social costs of accidents. Compilation procedure for financial costs. Cost data, quality and its limitations-Budgeting.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Occupational Health Definition</b> Role of WHO, Common occupational diseases, Occupations involving risk of contracting diseases, Mode of causation of the diseases and its effects, Diagnostic methods used for detecting occupational diseases. Biological monitoring. Evaluation of injuries, Hierarchy of control measures for occupational health risks, Occupational health management services at the work place. Lung function test on Medspirator, Ear testing on Audiometer. Physical health hazards, Chemical health hazards, Industrial dermatosis, Control methods and reduction strategies for air pollutants, noise and radiations. Prevention and control of occupational diseases. Environmental monitoring and occupational exposure limits.	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Environmental stresses</b> Physical, chemical, biological and ergonomic stresses, Principles of industrial hygiene, Overview of control measures. Permissible limits. Stress, Exposures to heat, Heat balance, Effects of heat stress, WBGT index measurement, Control Measures. Chemical agents, IS/UN classification, Flammables, Explosives, Water sensitive chemicals, Oxidants, Gases under pressure, Chemicals causing health hazards: irritants, asphyxiates, anaesthetics, systemic poisons and carcinogens, Chronic and acute exposure, Routes of entry, Types of airborne contaminants, Introduction to air sampling and evaluation methods, Engineering control measures, Principles of ventilation.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Occupational Safety, Health and Environment Management &amp; Personal Protective Equipments</b> 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 Personal Protective Equipments - Role of personal protective equipment, Selection criteria for personal protective equipment, Respiratory and non-respiratory type personal protective equipments. Case Study on Safety Aspects in Industries Safety in chemical industry, Safety in textile industry, Safety in pharmaceutical industry, Safety in food industry, Safety in mine industry.	<b>1</b>	<b>14</b>

## Practical SCP 2.2 based on SCT 2.2: Industrial Safety, Health and Environment

### External Marks 35

### Internal Marks 15

1. Measurement of Sound Levels.
2. Determination of concentration of inflammable vapours.
3. Measurement of Static Charge/Electricity with the help of Static Charge Meter.
4. Determination of Fire Load in a given work place.
5. Measurement of Vibrations of Machines and equipment.
6. Earthing continuity test.
7. Calibration of Rotameter by Wet Test Meter.
8. Detection of Carbon Monoxide, NO<sub>x</sub> Hydrogen Sulphide, Ammonia, Aromatic Hydrocarbons, SO<sub>2</sub> by Gas Detectors and other direct reading instruments.
9. Measurement of Concentration of Dust using Personal Sampler by Gravimetric Method.
10. Sampling and analysis of Ammonia.
11. Sampling and analysis of SO<sub>2</sub> using Colorimetric method.
12. Assessment of Heat Stress in Work Environment.
13. Plotting of an Audiogram by Audiometer.
14. Assessment of fire & explosion potential and their prevention.
15. Any other experiment as per the syllabus of theory courses and approval of the faculty
16. Visit to Fire and Safety office at MIDC areas.

### Recommended Books:

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).
5. The Factories Act-1948, Government Printing Press, Civil lines, Delhi (1994).
6. Risk Assessment and Environmental Management: D. Kofi Asvite-Dualy, John Willey & Sons, West Sussex, England (1998).
7. Introduction to Environmental Engineering & Science: Gilbert M. M., Pearson Education, Singapore (2004).
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, NewYork .
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. Grimaldi and Simonds , Safety Management, AITBS Publishers , New Delhi (2001)
7. Industrial Safety and pollution control handbook: National Safety Council and Associate publishers Pvt. Ltd, Hyderabad(1993).
8. Handbook of Environmental Health and Safety: Herman Koren and Michel Bisesi, Jaico Publishing House, Delhi (1999).



9. Handbook of Environmental Risk Assessment and Management: Peter Calow, Blackwell Science Ltd. USA (1998).
10. Risk Assessment and Environmental Management: D. Kofi Asvite-Dualy, John Willey & Sons, West Sussex, England (1998).
11. Introduction to Environmental Engineering & Science: Gilbert M. M., Pearson Education, Singapore (2004).
12. Safety A personal Focus David L Bever
13. Fire Equipment David L. Bever 14. Industrial Safety National Safety Council of India

**EST- OET 2.1: Environmental Geography**

**External Marks 70**

**Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Fundamentals of Environment Geography</b> Meaning and Scope of Environment Geography, Basic Principles of Environmental Geography: Composition and types of Environment, Ecosystem, Ecology, Ecological Principles, Homeostasis, Cybernatics, Ecological Equilibrium, Ecological Foot print, Restoration of Ecology. Carrying capacity, Ecological stress. Symbiosis between Man & Environment; Effect of Environment on Man: Biophysical, Resource Availability, Perceptual, Behavioural. Physical, Ecological and Human Ecological Issues, Organismic & Holistic Approach to Environment.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Ecosystem</b> Concept and components, Trophic levels, Food chains and food webs, Energy flow in the ecosystem, Ecosystem stability, High land – low land interactive system, human ecological adaptation.	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Environmental Degradation</b> Concept of Environmental Degradation, Environmental Pollution (Air, Water and Solid Waste), Ganga Pollution & Ganga Action Plan, Environmental Problems – Global Warming, Ozone Depletion and Green house effects, transformation of nature by man, global ecological imbalances, Desertification	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Environmental Management</b> Concept and approaches : Ecosystem Management Strategies, Environmental Dimension in Planning – Sustainable Development, Eco-Development, Limits to growth , Environmental Consciousness, National Environmental Policies and Programms, Environmental Impact assessment, Rio Summit, Kyoto Protocol, carbon sequestration and carbon trading.	<b>1</b>	<b>14</b>

**Practical OEP 2.1 based on OET 2.1: Environmental Geography**

**External Marks 35**

**Internal Marks 15**

- 1) Methods of Study of Physical and Cultural Environment
- 2) Organizational Model / Structural Mapping of Terrestrial and Aquatic Ecosystem.
- 3) Estimation, Computation and Projection of Organisms in Different Ecosystem.
- 4) Mapping of Pollution Zones
- 5) Noise Pollution
- 6) PH of Soil and Water
- 7) Nutrient Concentration in Soil
- 8) Dumpty level survey : Contouring and Profile drawing
- 9) Total Station for Contouring and Profile drawing
- 10) Prismatic Compass Survey: Closes Traverse error adjustment by Bowditch method and trigonometry.
- 11) Plane Table Survey: Two Point and three point problem. Triangulation and determination of heights and contouring with clinometers

- 12) Interpretation of Indian daily weather maps through the study of thermal and cloud conditions and pressure system, Weather forecasting method
- 13) Visit to polluted sites, forest, grassland areas, national Parks, meteorology department and desert areas.

**Recommended Books:**

- 1) Singh, L.R. et al : Environmental Management, Allahabad Geographical Society, Allahabad.
- 2) National Academy of Sciences : Understanding Climate Changes, Washington D.C.
- 3) Arvil, R. : Man and Environment, Penguin
- 4) Bennet, R.J. and Chorley, R.J. : Environmental System – Philosophy, Analysis and Control, Methuen, London. 6. Singh, Savindra : Environmental Geography, Prayag Pustak Bhawan, Allahabad
- 5) Detwiler, T.R. : Man's impact on the Environment, McGraw Hill, New York
- 6) Detwyler, T.R. and Marcus, M.G. : Urbanization and Environment, Duxbury Press, California.
- 7) Singh, Savindra : Paryavaran Bhoogol, Prayag Pustak Bhawan, Allahabad
- 8) Panwar, Mohan Singh (2007) - Environmental Changes and Sustainable Development in the New Millennium, Research India Press, New Delhi.
- 9) Adans, W.M. : Green Development : Environment and Sustainability in the Third World, Routledge, London, 2001
- 10) Mather, A.S. and Chapman, K. : Environmental Resources, Longman Group Ltd. U.K. 1995
- 11) Hobbs, J.B. : Applied Climatology, Butherworth, London
- 12) Park, C.C. : Ecology & Environmental Management, Botheworth, London
- 13) Bhatt, H.P. & Bhatt Sangita (ed) : Environment – Yesterday, Today and Tomorrow 1992, Galgotia Publication, New Delhi

**EST- OET 2.2: Hydrology & Watershed Management**

**External Marks 70**

**Internal Marks 30**

<b>UNITS</b>	<b>TOPICS</b>	<b>CREDIT</b>	<b>LECTURES</b>
<b>Unit -1</b>	<b>Atmospheric Water System &amp; Hydrological Cycle</b> Hydrologic cycle, Climate, Weather, Layers in atmosphere, Types and forms of precipitation, Hydro meteorological measurements, Cyclones, Fronts, Winds, Monsoon, Clouds, Requirements for Precipitation. Rainfall - Rain gauges, Adequacy of network, Spatial and Temporal distribution, Frequency and Intensity/duration analysis, Consistency, Missing data, Abstractions, Infiltration, Evaporation, Interception, Process, Estimation and Measurement, depression and detention storages.	<b>1</b>	<b>14</b>
<b>Unit -2</b>	<b>Watershed</b> Concept of watershed development, objectives of watershed development, need for watershed development in India, Integrated and multidisciplinary approach for watershed management. Water budget, Characteristics of Watershed, size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socioeconomic characteristics, basic data on watersheds.	<b>1</b>	<b>14</b>
<b>Unit -3</b>	<b>Measurement &amp; Control of Erosion</b> Types of erosion, factors affecting erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion, Universal Soil Loss Equation (USLE), Soil and Water Assessment Tool model, Measures to Control Erosion, Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rockfill dams, brushwood dam, Gabion, case studies of dams erosion problems.	<b>1</b>	<b>14</b>
<b>Unit -4</b>	<b>Ecosystem Management for watershed</b> Role of Ecosystem, crop husbandry, soil enrichment, inter, mixed and strip cropping, cropping pattern, sustainable agriculture, bio-mass management, dry land agriculture, Silvi Pasture, horticulture, social forestry and afforestation. Selection of plant species for plantation, Organic farming and organic fertilizers. Agriculture and water management – participatory rural appraisal in watershed programs, community mobilization. Social Institutions: Gram-Panchayat, Self-help Groups for Women, Farmer. Managed small-scale irrigation systems (cooperative – Liftirrigation); Watershed Development Committees. people’s participation, preparation of action plan, and role of NGO in watershed management with case studies.	<b>1</b>	<b>14</b>

## **Practical OEP 2.2 based on OET 2.2: Hydrology & Watershed Management**

### **External Marks 35**

### **Internal Marks 15**

1. Study of drainage patterns, slopes and slope analysis.
2. Watershed survey equipments with information
3. Tracing of watershed and their morphological features from toposheets
4. Aerial photographs and satellite imageries with interpretations
5. Problems in water budgeting.
6. Problems on USLE and SWAT models
7. Designing structures for water conservation and harvesting based on field visits.
8. Build a physical model of a watershed.
9. Identify watershed features such as drainage divides, rivers, tributary
10. Use Google Earth to view watershed features.
11. Locate watershed in and around campus.
12. Describe land cover and population changes within a watershed.

### **Recommended Books:**

1. Common guidelines for watershed development projects (2008). Government of India
2. Dhruva N.V.V., Sastry G.O., (1990): Watershed management, ICAR, New Delhi.
3. Frevert R.K., Schwab G.O., Edminster T.W., and Barnes K.K. (2009) Soil and water conservation engineering, 4th edition, John Willey and Sons, New York.
4. Jain S.K. and Sing V.P. (2006) Water resources system planning and management, Elsevier India, New Delhi
5. Mukherjee A. (2004) Participatory learning and action: Monitoring and evaluation and participatory monitoring and evaluation, Concept Publishing Company, New Delhi.
6. Rao K.V.S. (2003) Watersheds: comprehensive development, B.S. Publication.
7. Sharda V.N., Sikka A.K. and Juyal G.P. (2006) Participatory integrated watershed management: A field manual, central soil and water conservation research training institute, Dehradun.
8. Singh R.V. (2003) watershed planning and management, Yash Publication, Bikaner
9. Water Resources Projects and their Environment Impact – Abbasi S.A. Discovery Pub. House, New Delhi 2001.
10. Land and Water Management by VVN Murthy, - Kalyani Publications.
11. Irrigation and Water Management by D.K. Majumdar, Prentice Hall of India
12. Hydrology and Soil Conservation Engineering by Ganshyam Das
13. Watershed Management by JVS Murthy, - New Age International Publishers.
14. Water Resource Engineering by R. Awurbs and WP James, - Prentice Hall Publishers.