

1) Title of the course - F.Y.B.Sc. Environmental Science

2) Preamble of the syllabus–

The proposed syllabus for F. Y. B. Sc Environmental Science is structured & designed to ensure ‘well versed-ness’ with the basic, scientific concepts of many of the current environmental issues & happenings; hence the course paper titles – Fundamentals of Environmental Chemistry, Fundamentals of Environmental Biology, Fundamentals of Environmental Pollution & Fundamentals of Environmental Geosciences.

The course is intended as a stepping stone to subsequent higher orders of learning & understanding, in any of the chosen areas in the discipline of Environmental Science; keeping in mind the ‘interdisciplinary nature’ of this discipline itself.

Theory related laboratory practicals, field visits & demonstration sessions are incorporated to the course structure as EVS- 103. This is likewise intended to encourage incitation of a thought process & hence, development of a practical perspective amongst the students, when addressing an environmental issue.

The proposed theory topics are described in detail to the extent that was considered sufficient for this level of learning. The syllabus is also an attempt to make the learning process an interesting one, through the inclusion of certain ‘Case Studies’, by which it is expected that the students will be able to relate to the issues more wholesomely .

It is hoped that this proposed syllabus for the F. Y. B. Sc. level & that ensuing for the subsequent levels, as a part of this syllabus development program; will not only serve its purpose of bringing informed sensitization towards the environment but also increase student competency & employability.

3) Introduction - Annual Pattern.

4) Eligibility – 10+2, Science.

5) Examination

A) Pattern of examination-

i) Internal Theory Exams + Annual Theory University Exams..... (20+80) marks
Internal Practical Exam + Annual Practical University Exam..... (20+80) marks

ii) Pattern of the question paper–

Annual Theory Papers..... Maximum Marks - 80

Q1) 2 marks X 8..... 16 marks
Q2) 4 marks X 4..... 16 marks
Q3) 4 marks X 4..... 16 marks
Q4) 8 marks X 2..... 16 marks
Q5) 16 marks X 1..... 16 marks

Annual Practical Paper.....Maximum Marks – 80

- Q1)10 marks
- Q2)10 marks
- Q3)10 marks
- Q4)10 marks
- Q5) 3 marks X 5.....15 marks
- Q6)10 marks
- Q7)(10 + 5) marks.....15 marks

- B) Standard of Passing– As per the University norms.
- C) ATKT Rules– As per the University norms.
- D) Award of Class– As per the University norms.
- E) External Students–As per the University norms for the Faculty of Science.
- F) Setting of Question paper / Pattern of Question paper–

Annual Theory Papers (EVS – 101 & EVS - 102).....Maximum Marks – 80
(All Compulsory Questions)

- Q1) Answer the following in not more than 5 lines.....16
 - a)
 - b)
 - c)
 - d)
 - e)
 - f)
 - g)
 - h)

- Q2) Answer any four of the following.....16
 - a)
 - b)
 - c)
 - d)
 - e)
 - f)

Q3) Write short notes on any four of the following.....16

- a)
- b)
- c)
- d)
- e)
- f)

Q4) Answer any two of the following.....16

- a)
- b)
- c)
- d)

Q5) Answer any one of the following.....16

- a)
- b)

Annual Practical Paper (EVS – 103).....Maximum Marks – 80
(All Compulsory Questions)

Q1) Determine the pH/ Electrical conductivity of the given water/ soil samples.
Comment on the result.....(10 marks)

OR

Determine the Moisture Content/ Water Holding Capacity of the given water
sample. Comment on the result.....(10 marks)

Q2) Determine the Alkalinity/ Chloride Content of the given water sample.
Comment on the result.....(10 marks)

OR

Determine the Gypsum Requirement/ Organic Content of the given soil sample.
Comment on the result.....(10 marks)

Q3) Determine the TDS, TSS & TS of the given water sample. Comment on the
result.....(10 marks)

OR

Determine the Ca Hardness, Mg Hardness & Total Hardness the given water
sample. Comment on the result.....(10 marks)

Q4) Measure the Noise Level of the given locality (/localities) using Noise Level Meter/ Turbidity of the given water body using Secchi disk. Comment on the result.....(10 marks)

OR

Measure the temperature & analyse the particle size & texture of the given soil sample. Comment on the result.(10 marks)

Q5) Spotting.....(3 marks X 5= 15 marks)

A) Any studied Plant Fossil Form/ Any of the used Laboratory Instrument

B) Plant / Animal Forms

C) Plant / Animal Diseases. OR Equipment / Glassware / Material / Chemicals used in culturing microbes

D) Plant / Animal Adaptations. OR Planktons / Bioindicatorsof an Eutrophicated lake.

E) Rock / Mineral

Q6) Report & verification of the use of Social Media for e-networking & dissemination of ideas on any environmental issue/s.....(10 marks)

Q7) A) Visit Report & Field Practical Report.....(5+5=10 marks)

B) Viva Voce & Certified Journal.....(5 marks)

G)Verification / Revaluation– As per the University norms.

6) Structure of the Course -

a) Compulsory paper– EVS – 101 (Theory); EVS – 102 (Theory); EVS – 103 (Practical).

Paper	Term	Course No.	Course Title
I	I	EVS - 101	Fundamentals of Environmental Chemistry
	II	EVS - 101	Fundamentals of Environmental Biology
II	I	EVS - 102	Fundamentals of Environmental Geosciences
	II	EVS - 102	Fundamentals of Environmental Pollution
III	I & II	EVS - 103	Practicals - I

b) Optional papers– NIL

c) Question paper & papers etc... -

- Weightage to each Course Titles -

Paper	Term	Course No.	Course Title	Marks Distribution	Total Marks
I	I	EVS - 101	Fundamentals of Environmental Chemistry	50 (10+40)	100
	II	EVS - 101	Fundamentals of Environmental Biology	50 (10+40)	
II	I	EVS - 102	Fundamentals of Environmental Geosciences	50 (10+40)	100
	II	EVS - 102	Fundamentals of Environmental Pollution	50 (10+40)	
III	I & II	EVS - 103	Practicals - I	100 (20+80)	100

- Question Paper pattern – same as in 5F.

d) Medium of Instructions– English

7) Equivalence of previous syllabus along with proposed syllabus -

Structure of the old syllabus

Paper	Term	Course No.	Course Title	Marks Distribution	Total Marks
I	I	ENV - 101	Life Sciences: Basic Biology	50 (10+40)	100
	II	ENV - 101	Life Sciences: Natural Resources	50 (10+40)	
II	I	ENV - 102	Earth Sciences: Environmental Chemistry	50 (10+40)	100
	II	ENV - 102	Earth Sciences: Basic Geosciences	50 (10+40)	
III	I & II	ENV - 103	Practical based on ENV-101 & ENV-102	100 (20+80)	100

8) University terms-

9) Subject wise Detail Syllabus– Attached below.

10) Recommended books–Mentioned paper wise, with the syllabus below.

11) Qualification of Teacher- As per UGC & University rules.

University of Pune
F.Y.B.Sc. Environmental Science
Revised Syllabus 2013-14
Course Design

Paper	Term	Course No.	Course Title	Marks Distribution	Total Marks
I	I	EVS - 101	Fundamentals of Environmental Chemistry	50 (10+40)	100
	II	EVS - 101	Fundamentals of Environmental Biology	50 (10+40)	
II	I	EVS - 102	Fundamentals of Environmental Geosciences	50 (10+40)	100
	II	EVS - 102	Fundamentals of Environmental Pollution	50 (10+40)	
III	I & II	EVS - 103	Practicals – I (Based on EVS 101 & 102)	100 (20+80)	100

Paper - I, Term - I, EVS – 101

Fundamentals of Environmental Chemistry

(T.L- 36)

Unit No.	Name of the Unit	Contents	No. Of Lectures
1	Introduction	<ul style="list-style-type: none">• Scope of Environmental Chemistry.• Segments of Environment and various interactive reactions occurring between these segments.• Bio-geo-chemical cycles• Green Chemistry	06
2	Chemistry of Some Atmospheric Gases	<ul style="list-style-type: none">• Characteristic of the Chemical Reactions involved in atmosphere.• Sulphur- Oxides Chemistry.• Nitrogen-Oxides Chemistry• Carbon Oxides Chemistry	06
3	Chemistry of Water	<ul style="list-style-type: none">• Unusual physical properties, Hydrogen bonding.• Changes in water properties on addition of solute.• Water interaction with gases and earth minerals.• Microbial transformation of carbon, Nitrogen, Phosphorus, Hydrocarbons and Iron.	06
4	Chemistry of some Heavy Metals	<ul style="list-style-type: none">• Chemistry of Pb, Hg, Cd and Ar• Physical and chemical properties• Behavior of these heavy metals and their compounds• Human exposure-absorption and influence	06
5	Chemistry of Surfactants and chemicals in food	<ul style="list-style-type: none">• Cationic, Anionic ,and non-ionic detergents, modified detergents• Food additives (preservatives, flavoringagents, coloringagents), pesticide remains, adulterants-properties and their effects.	06
6	Environmental Analysis	<ul style="list-style-type: none">• Solution concentration (Normality, Molarity, Molality, ppm, Equivalent weight etc.)• Titrimetric methods.• Instrumentation, Principle and working of pH meter and conductivity meter.	06

Reference Books -

- 1) Environmental Chemistry, A. K. De, New Age International Publishers, 7thEdtn.
- 2) Elements of Environmental Chemistry, H. V. Jadhav, Stosius Incorporated/Advent Books Division, 1992
- 3) Environmental Chemistry, H. Kaur, APragatiEdtn., 2ndEdtn. (2007)
- 4) Environmental Chemistry, S. K. Banerjee, PHI Learning Pvt. Ltd., 2nd Edtn.

Paper - I, Term - II, EVS – 101

Fundamentals of Environmental Biology

(T.L- 36)

Unit No.	Name of the Unit	Contents	No. Of Lectures
1	Biology	<ul style="list-style-type: none">• Introduction to Biology, Branches, Scope and Importance in today's context from environmental point of view. Charles Darwin's Voyage of HMS Beagle – His theory of 'Survival of the Fittest'. Biological diversity of India – Major genera, species, sub-species of flora and fauna. Major ecological types of India	06
2	Origin of Life	<ul style="list-style-type: none">• What is Life? The origin of Life; Evolution of Life through the geological time i.e. – Eras, Periods, Epochs; Events of (Evolutionary) 'Explosions' and 'Mass Extinctions' &, Paleontological Evidences for these.• The current 'Mass Extinction' with reference to rate of extinction, factors responsible and possible remedies.	06
3	Biogeography	<ul style="list-style-type: none">• A glimpse of the present day distribution of Life on Earth; The factors responsible – (i) Geological - Continental Drift- Barriers and Bridges, (ii) Climatic - Barriers and Bridges, (iii) Evolutionary - Speciation etc.• Biogeography – The meaning; Biographical profile of the world and India; The physical, microbial, floral and faunal characteristics of each Biogeographical zone.	06
4	Taxonomy	<ul style="list-style-type: none">• Taxonomic Principles - aim, objectives, hierarchy, kingdoms.• History; Linnaeus system of classification; Bentham & Hooker system of classification.• Components of systematic - characterization, classification, identification & nomenclature.• The concept of species- morphological, biological, phylogenetic, ecological etc.	06

5	Classification	<ul style="list-style-type: none"> • Classification based on form - <ul style="list-style-type: none"> i) Plants - algae, bryophyte, pteridophyte, gymnosperm, angiosperm (monocot & dicot) ii) Animals – <ul style="list-style-type: none"> a) Invertebrates - arthropods - insects b) Vertebrates – fishes, amphibians, reptiles, birds & mammals. iii) Microbes – viruses, bacteria & fungi • Life Forms on Earth - <ul style="list-style-type: none"> i) Terrestrial Life forms - floral & faunal ii) Aquatic (fresh water & marine) life forms - floral & faunal iii) Microbial Life (fungi, bacteria & viruses) in air, water & soil 	06
6	Ecology and Bio-resources	<ul style="list-style-type: none"> • Ecological Adaptations under various environmental conditions – <ul style="list-style-type: none"> i) In plants - hydrophytes, mesophytes, epiphytes, xerophytes & halophytes ii) In animals - mimicry, vestigiality etc. • Bio-resources- <ul style="list-style-type: none"> i) Forests- major types of the world & India ii) Agricultural crops - major food plants of the world & India iii) Livestock – major varieties of the world & India iv) Fisheries resources - saline & fresh water • Significances / use of the Bioresources; Extraction of Bioresources by traditional & modern methods; Threat to local bioresources - overexploitation, habitat loss, invasive species etc. 	06

Reference Books -

- 1) 'A Textbook of Plant Ecology' Ambashta R.S. & Ambashta N.K (1999) CBS Publ. & Distributers, New Delhi
- 2) 'Ecology: Principles and Applications' Chapman J.L. & Reiss M.J. (1995) Cambridge University Press
- 3) 'Environmental Science: A Global Concern' Cunningham W.P. & Saigo S.W. (1997) WCB, McGraw Hill
- 4) 'Elements of Ecology' Sharma P.D. Rastogi Publication
- 5) 'Environmental Science' Tyler M.G. Jr. (1997) Wadsworth Publ. Co.
- 6) 'Environmental Studies' Benny Joseph (2005) Tata McGraw Hill Publ. Co. Ltd.
- 7) 'Patterns in the Living World' – Biology-an Environmental approach, John Murray, London
- 8) 'Diversity Among Living Things' Biology-an Environmental approach, John Murray, London
- 9) 'Paleobotany and the Evolution of Plants' Wilson N. Stewart (1983) Cambridge University Press
- 10) Biological science, D. J. Taylor, N.P.O. Green & G.W Stout, Cambridge Low Price Edition, 3rd Edtn.
- 11) Holmes' Principles of Physical Geology, Edt. By P. McL. D. Duff, ELBS with Chapman & Hall, 4th Edtn.
- 12) An Advanced textbook on Biodiversity – Principles & Practice, K. V. Krishnamurthy, Oxford & IBH Publishing Co. Pvt. Ltd., Special Indian Edtn.

Paper - II, Term - I, EVS – 102

Fundamentals of Environmental Geosciences

(T.L- 36)

Unit No.	Name of the Unit	Contents	No. Of Lectures
1	Earth & it's Structural Components	<ul style="list-style-type: none">• Internal Structure of Earth• Theories of geological evolution – Wagener's Continental Drift Theory, Plate Tectonic Theory• Types of Rocks – Igneous, Sedimentary, Metamorphic• Rock cycle• Rock forming minerals – quartz, feldspar, micas, clay minerals, calcite, dolomite etc.• Floral & Faunal species continuity between biogeographic regions	06
2	Soil	<ul style="list-style-type: none">• Formation – weathering processes (types), biomass addition• Physical & chemical properties; composition; macro & micro plant nutrients• Soil Profile• Soil classification• Soils of India – with respect to their agriculture significances.	06
3	Earth's atmosphere	<ul style="list-style-type: none">• Introduction, general properties• Vertical & horizontal structures• Chemical composition – in each of the vertical layers; past & present• Significance	06
4	Atmospheric temperature	<ul style="list-style-type: none">• Atmospheric temperature measurement –<ul style="list-style-type: none">i) Instruments;ii) Methods (maximum, minimum, mean temperature, temperature range);iii) Factors regulating atmospheric temperature/ temperature controls• Lapse rate; Types – ELR, DALR & WALR• Temperature inversion -<ul style="list-style-type: none">i) Types – radiation, advection, frontal, subsidence, turbulence/ convective inversions	06

		ii) Temperature inversion & atmospheric stability	
5	Hydrological cycle & Atmospheric pressure	<ul style="list-style-type: none"> • Hydrological cycle – <ul style="list-style-type: none"> i) Introduction & significance ii) Evaporation; Factors affecting the rate of evaporation iii) Condensation; Factors affecting the rate of condensation; Forms of condensation – dew, frost, fog & cloud. iv) Precipitation; Factors affecting precipitation; Forms of precipitation – rain, drizzle, snow, hail, sleet etc. • Atmospheric pressure – <ul style="list-style-type: none"> i) Introduction; Measurement; Factors affecting the atmospheric pressure ii) Spatial & Temporal variations iii) Atmospheric pressure & Generation of winds; Factors affecting winds 	06
6	Natural Calamities & Resources	<ul style="list-style-type: none"> • Natural Calamities – Volcanoes, Earthquakes, Landslides, Cyclones, Floods & Droughts; Causes; Planning & Management to prevent/mitigate their effects; Case studies for each. • Significance of wind, geothermal & solar energy as alternative energy resources. 	06

Reference Books -

- 1) Environmental Geology ;Valdiya K.S.; Indian Context. Tata McGraw Hill
- 2) Essentials of Climatology ; D. S. Lal; Chaitanya Publishing House, Allahabad, 1989.
- 3) Holmes' – Principles of Physical Geology; Edt. by P. McL. D. Duff; ELBS-Chapman & Hall Low Priced Edtn; 4thEdtn.
- 4) A Textbook of soil Science; T.D. Biswas& S.K. Mukharjee; Tata McGraw-Hill Education
- 5) Introductory Soil Science; Dilip Kumar Das; Kalyani Publishers; 2ndEdtn.
- 6) Environmental Geology; Kellar E.A. (2011); Prentice Hall, 624 p; 9thEdtn.

Paper - II, Term - II, EVS – 102

Fundamentals of Environmental Pollution

(T.L- 36)

Unit No.	Name of the Unit	Contents	No. Of Lectures
1	Introduction	<ul style="list-style-type: none">• Pollution – Definition; Types – On the basis of physical environment (soil, water, air) On the basis of types of pollutants• Pollutants – Definition; Types – Primary, secondary Biodegradable, non-biodegradable Solid, liquid, gaseous etc.• Sources – Point source, non-point source Stationary, mobile Natural, anthropogenic• Effects	6
2	Air Pollution	<ul style="list-style-type: none">• Definition; Major air pollutants and their sources; Extremely hazardous pollutants by OSHA• Effects – On Biological system – Animals, humans & plants On Non Biological systems – material; physical environment (Green House Effect, Ozone depletion, Smog, Acid deposition, Intensification of thermal inversion)• Chemistry & Control measures – Ozone depletion, smog, acid deposition, greenhouse effect & global warming• Case studies – London smog; Los Angeles smog; Acid deposition – Taj-Mahal, acid rains in Boreal forests.	
3	Water pollution	<ul style="list-style-type: none">• Definition• Types, Sources, Effects & control measures – Detergent – Eutrophication Pesticide – Bioaccumulation, biomagnifications Heavy metal pollution – Pb, Hg, Cd & Ar. Ground water pollution Surface water pollution Marine pollution – Oil spills• Case studies – Itai- Itai&Minamata (Japan); Arsenic poisoning (West Bengal) etc.	6
4	Soil pollution	<ul style="list-style-type: none">• Definition; Sources/ routes of contamination• Effects – On soil quality/ productivity – Acidification, Alkalinization, Salinization, Sodification, Desertification, Heavy metal	6

		<p>deposition etc. On Biological system – on soil microorganisms, on plants.</p> <ul style="list-style-type: none"> • Control measures/ Alternatives – Biofertilizers& biological pest management; Organic farming & other agricultural interventions; Appropriate irrigation & drainage techniques; Lime& gypsum application. • Case studies – Declining soil productivity in the Punjab & Haryana; desertification in India; 	
5	Noise and Solid Waste pollution	<ul style="list-style-type: none"> • Noise Pollution <ul style="list-style-type: none"> i) Measurement & sources of noise ii)Effects- On Man – Auditory & non auditory On plants, animals & materials. iii)Control measures • Solid Waste Pollution <ul style="list-style-type: none"> i)Causes ii)Source and characterization iii)Impact of Urbanization iv)Effects • Any/ local case study of Noise Pollution or Solid Waste Pollution 	6
6	Thermal & Radioactive Pollution	<ul style="list-style-type: none"> • Thermal Pollution – <ul style="list-style-type: none"> i)Definition; Sources of thermal water pollution & thermal air pollution ii)Effects – <ul style="list-style-type: none"> a) Of thermal water pollution on - physiochemical quality of water & aquatic life b) Of thermal air pollution on - physical environment & biological system iii)Control measures • Radioactive pollution – <ul style="list-style-type: none"> i)Definition – radioactivity; sources – natural &anthropogenic ii)Effects to various degree of radiation exposure iii)Control measures iv)Case studies – Chernobyl, Hiroshima - Nagasaki 	6

Reference Books -

- 1) Air Pollution- M. N. Rao&H. V .N. Rao; Tata McGraw Hill, New Delhi, 1989.
- 2) "Environment Pollution Control and Environmental Engg." C. S. Rao , Tata McGraw Hill, New Delhi, 1994.
- 3) Soil pollution & Soil Organism - P.V. Mishra
- 4) Water Pollution—A.K. Tripathy& S.N. Pandey; A. P. H. Publishing Corporation
- 5) Environmental Air pollution & it's control—G.R. Chatwal; Anmol Publications, New Delhi, 1989
- 6) Environmental Chemistry; A. K. De; New Age International Publishers; 6thEdtn.
- 7) Understanding Environment; Edt by Kiran B. Chhokar, MamataPandya, MeenaRaghunathan; Centre for Environment Education; Sage Publication.
- 8) Prespective in Environmental Studies; Kaushik&Kaushik; New Age International Pvt. Ltd Publishers
- 9) Environmental Science; S. C. Santra; New Central Book Agency (P) Ltd.; 2ndEdtn.
- 10)Water Pollution, P.K. Goel,New Age International, 2006 Revised Edtn.

P-III, EVS- 103 Practicals based on EVS 101 & EVS 102

(Any 24 Practicals are to be conducted out of the following 29 Practicals. At least one Field Practical and one Visit are mandatory.)

Sr. No.	Description	Practical Sessions
1.	Laboratory safety rules and introduction to laboratory equipments	01
2.	Collection and preservation of water and soil samples (Field Practical).	02
3.	Determination of pH & Electrical Conductivity from water.	01
4.	Determination of Alkalinity from water.	01
5.	Determination of Total Hardness (Ca & Mg) from water.	01
6.	Determination of Chlorides from water.	01
7.	Determination of TDS, TSS & TS from water	01
8.	Determination of Turbidity in water by Secchi disc (Field practical).	01
9.	Determination of pH & Electrical Conductivity from soil.	01
10.	Study of soil properties – Temperature, texture and particle size	01
11.	Estimation of the Moisture Content & Water Holding Capacity of soil.	01
12.	Determination of Organic Content from soil.	01
13.	Estimation of Gypsum required for Alkaline soil.	01
14.	Measurement of Noise using Sound Level Meter (Field Practical).	01
15.	Collection and characterisation of planktons/plant bio-indicators from eutrophic lake(Field Practical).	01
16.	Study of the working of PUC machine-Gas Analyser(Demonstration).	01
17.	Identification of different Rock specimens from their physical properties.	01
18.	Identification of different Mineral specimens from their physical properties	01

19.	Study of Plant Fossil Forms from different geological periods/visit to Paleo-botanical museum	01
20.	Study of various Plant Forms (Specimens).	01
21.	Study of various Animal Forms (Specimens).	01
22.	Study of Plant Adaptations under various environmental conditions (hydrophytes, mesophytes, epiphytes, halophytes & xerophytes).	01
23.	Study of Animal Adaptations under various ecological conditions (mimicry & vestigiality).	01
24.	Study of Plant & Animal Diseases (one each of viral, bacterial & fungal).	01
25.	Preparation of Media for microbial culture.	01
26.	Isolation & Culture of microbes from soil/ water.	02
27.	Visit to a Natural Area/ Wildlife Sanctuary/ National Park to inventorize & study the various bioresources.	01 Day
28.	Visit to Weather Station.	01 Day
29.	Use of social media for e-networking and dissemination of ideas on environmental issues.	02

Reference Books-

- 1) Handbook of methods in Environmental Studies Vol—I & II; S.K. Maiti; ABD Publishers, Jaipur, India
- 2) Physico-Chemical Examination of water, sewage and industrial effluents. Manivaskam, N., 1984. PragtiPrakashan, Meerut
- 3) Chemical and biological method for water pollution studies. Trivedi, R.K. and Goel, P.K., 1986. Environment Publications, Karad
- 4) Instrumental methods of analysis; Willard; cbspd; 7th Edtn.