AC - 11th May, 2017
Item No. 4.285

AC Item No.

UNIVERSITY OF MUMBAI

Program: B.Sc.

(Credit Based Semester and Grading System)

Course: Environmental Science

(Applied Component)

Syllabus for Semester V & VI

(with effect from the academic year 2017-18)

CONTENTS

PREFACE

Applied Component was introduced for T. Y. B. Sc. class in the academic year 1979-80 with a view to enhance the essence for employability. The syllabus is a blend of concepts with four electives. It gives me immense pleasure to present these four applied component courses namely Marine Science, Fishery Biology, Economic Entomology and Environmental Science under the umbrella of BOS in Zoology.

In the syllabi of these applied components, applied topics having commercial propositions have been incorporated that further ads to the enhancement of entrepreneurial potential and skills amongst the learners. In the past our syllabus focused mainly on theory as a way of providing knowledge base and preparation for students. We have attempted to go beyond this tradition, while doing so; equal emphasis is laid on theory and corroborative practicals. From the academic year 2011-12, the University has introduced Credit Based Semester and Grading System (CBSGS). Accordingly the existing syllabi of these applied components were restructured to fit into the CBSGS pattern. The concept of flexi syllabus was introduced offering opportunity to learners to study any four out of a total of eight units in each course. Now that the syllabus is restructured and to be introduced from the academic year 2017-2018, we have included a novel concept of open unit and case studies. This approach, I'm sure will enhance the critical and analytical thinking abilities of the students.

I take this opportunity to thank the experts in various fields for giving valuable, beneficial and constructive suggestions during framing of the syllabus. The syllabus committee under the convenorship of Mr. Vinayak Dalvie has done a commendable job of timely framing the syllabus with a highest degree of precision and accuracy. While appreciating the efforts, I also express my thanks and heartfelt gratitude to the entire team.

– Dr. Anita Jadhav
Chairperson,
Ad-hoc BOS in Zoology

PREAMBLE

As a convener when I mooted the concept of flexi-syllabus, first of its kind, in the academic year 2009-10 it was grossly misconstrued. To add to it I also placed an idea of including case studies and introducing a new concept of ‘Open Unit’. Both were rejected then. I had also proposed a new subject ‘Entrepreneurial and Industrial Biology’ in place of the existing Applied Components usually offered by the students of Biological Sciences. Twenty workshops in different districts with teachers and students of various subjects were conducted to explain these four concepts. A twenty one days refresher course for teachers, sponsored by UGC was also conducted in the new subject of ‘Entrepreneurial and Industrial Biology’ which was much appreciated by the then Director of NAAC, Prof H. A. Ranganath, who is from Biological Sciences, understanding the potential of the subject. However, implementation was postponed for technical reasons thus permitting innovation limited to the flexi-syllabus, implemented in 2010-11, which has inherent capacity to cater to the diverse needs of the region and the industry by allowing students and teachers to choose a desired capsule of eight topics, with various permutations and combinations from the menu of sixteen based on the interest, resources, expertise and need. It took care of a range of students by also providing learners' space to high IQ students. Yet the possibility of exclusion of some important topics cannot be ruled out apart from some new avenues developed during the lag phase of revision of syllabi. Open unit will permit a good teacher to keep pace with the development and adopt latest topics instantly without waiting till it becomes obsolete in the gap of 5 years that the University generally takes to revise the syllabus. It may also allow students to learn the existing topic in more details and depth under the open unit thus making them specialized in need based areas enhancing employability. Assignments would add to their understanding of Government schemes, regulations and market, while projects will augment Business Sense or Scientific Acumen, as the case may be. Case studies and simulations, introduced for the first time in Zoology, would pose challenge for true application of knowledge to real life situations with thought provoking questions demanding analytical solutions. Pedagogy of such dynamic syllabus will range from use of ICT in the class to teaching directly in the field with a blend of participative and experiential learning with group dynamics gaining true knowledge apart from developing personality of the students and above all making them apply ‘Common Sense’ which is the essence of life. I am sure dedicated team of Zoologists which has placed the subject on top in the past 5 years is poised to make it a success in every college befitting the purpose of introducing applied component by the University in the academic year 1979-80.

- VINAYAK DALVIE
Convener,
Syllabus Committee

PEDAGOGY

The concept of having a flexi syllabus is a unique feature of this syllabus and implementing it creatively and diligently would be a meaningful exercise. The concept of flexi syllabus would ensure that learner and facilitator have the liberty to select any four units out of eight which can be decided by both the stake-holders collectively. While selecting, both shall ensure that it is done systematically, maintaining the relevance of topics in every unit taught in the semester. An exciting aspect adding a new dimension to the flexi-syllabus concept is the idea of making various permutations and combinations of the units in every semester that would take into consideration the need, resources and the expertise that the department, college possesses/ provides or can make available.

A major thrust should be to direct the learner to maximize the use of ICT, watch films related to the topics, You-tube clippings and extra read material in the form of articles and magazines for all the topics, 'Buzz sessions' should be held after showing films, short video clippings etc, whereby the learner is encouraged to summarize the contents, or debate or ask questions related to the topics. This exercise would initiate a 'thought process' with respect to the subject, ensuring that the learner develops a habit of ruminating over the information to gain conceptual clarity and insights.

It is recommended that the facilitator employs a variety of approaches in teaching learning methods that are necessarily active and participatory in nature. These may include debate and discussions, field trips, study tours and industrial visits, both short and long, to places of environmental concerns relevant to the units prescribed and selected for teaching so as to provide desired exposure. For e.g. Units on Biodiversity Conservation and Ecotourism, Industrial Consultancy, Business Analytics of Environment testing, Neo avenues should not be taught only in class-rooms but, on locations, to promote experiential learning.

'Case studies' should be conducted through discussion in a group of 10 students for every case. A case study approach to investigate an environmental issue would help the learner to appreciate the importance of gathering relevant evidence, evaluating its quality and interpreting the results. It must be developed and presented by the facilitator (teacher) with thought provoking approaches expecting students to think analytically and derive an appropriate solution after critically evaluating all the solutions, given within the group.

The inclusion of the concept of 'open unit' encourages the creative teacher-facilitator to choose a topic from the existing units which needs to be further elucidated or taught or researched so as to gain in depth knowledge on the topic and can hence be covered extensively. On the other hand the topic taught could also be a 'need based' one either comprehensively covered by the syllabus or totally ignored. If the facilitator has the ability to include a newly developed area, within the vicinity, then it may be included in the open unit with the consent of the Head of the Department and the Principal of the institution.

This new syllabus takes into consideration the applied approach, and therefore the topics chosen are practical although few theory based topics are retained. All the practical experiments are application oriented and simple since the learners have had exposure to them while performing them in the former years or in their mainstream subject covered under the science streams. While performing them the learner develops the aptitude of putting them into practice scientifically, logically and appropriately for studying various aspects of the environment and the pollution caused due to anthropogenic activities. Facilitators must encourage the learners to comprehend and generate ideas for the applicative value of these experiments.

Furthermore the syllabus has also incorporated the skeleton question paper for the practical examination and the model question paper for the theory units so as to resolve any doubts and ensure uniformity in the drafting of the question paper pattern for the semester end examination.

Co-Convenors,

Syllabus Committee

T. Y. B. Sc.

Credit Based Semester and Grading system

Environmental Science & Pollution (Applied Component)

Syllabus

(to be implemented from the academic year 2017-18)

Semester V
Applied Environmental Sciences

Theory (Any four units to be opted)				
Course	**Unit**	**TOPIC**	**Credits**	**L/Week**
USACEVS501	1	Introduction to Environment and Pollution	2	4
	2	Green Chemistry and Sustainability		
	3	Alternate Energy Resources		
	4	Applications of Analytical methods		
	5	Green/Environmental Audit		
	6	Industrial Consultancy		
	7	Neo-avenues		
	8	Case Study and Simulation		
Practical				
USACEVS5P1		Practicals based on Course**USACEVS501**	2	4

Semester VI
Environmental Management

Theory (Any four units to be opted)				
Course	**Unit**	**TOPIC**	**Credits**	**L/Week**
USACEVS601	1	Business Analytics of Environment Testing	2	4
	2	Ecological Restoration		
	3	Impact Assessment through Ecological modeling		
	4	Finance		
	5	Biodiversity Conservation and Ecotourism		
	6	Climate Change		
	7	Environmental Education and Legislation		
	8	Open Unit		
Practical				
USACEVS6P1		Practicals based on Course **USACEVS601**	2	4

Semester V: Theory
Applied Environmental Sciences
Course code: USACEVS501

(Any four units to be opted**)**

Lectures 60
Credits 2

Unit 1: Introduction to Environment and Pollution
Objective:

- *To revise the important concepts of environment and its impact on the inter-relationship between various components of the environment.*
- *To recognise and realise, the harmful effects of pollutants on the environment, when their balance shifts as a result of anthropogenic activities*.

Desired Outcome:

- *Learner shall comprehend the impact of the interrelationship between various components of environment.*
- *Learner will apply the knowledge of pollutants to undertake research projects/studies.*

1.1 Components of environment; biotic and abiotic. Composition of various segments of environment–atmosphere, hydrosphere, lithosphere, biosphere (with respect to composition and interrelationship).
1.2 Types of pollution
1.2.1 Water pollution: Pesticides and heavy metals.
1.2.2 Air pollution: Challenges posed by present day pollutants.
1.2.3 Others- Noise and nuclear pollution.

Unit 2: Green chemistry and Sustainability
Objective:

- *To direct the learner's aptitude and skills to develop innovative chemical technology, aimed to reduce or eliminate the use or generation of hazardous substances.*

Desired Outcome:

- *Learner would be critical and creative during the designing, manufacturing and utilization of chemical products, which would reduce or eliminate the use or generation of hazardous substances.*

2.1 The Twelve Principles of Green Chemistry.
2.2 Sustainable Development- Principles and sustainable development indicators.
2.3 Areas highlighted by Agenda 21.
2.4 Transition from Industrial economy to Green economy.

Unit 3: Alternate Energy Resources
Objective:

- *To comprehend, the importance of alternative energy resources.*
- *To emphasise the need, to conserve the energy resources.*

Desired Outcome*:*

- *Learner shall value the alternative energy resources and hence follow the 4 R's (Reduce, Reuse, Recycle & Reinvent).*
- *Learner may discover and design products, operations or processes, which conserve the energy resources.*

3.1 Solar energy, wind energy, tidal energy, nuclear energy.

3.2 Biomass & bio-fuels, petro crops.

3.3 Use of wastes: Water-based biomass, energy from waste & solid waste.

Unit 4: Applications of Analytical Methods

Objective:

- *To re-familiarise the principles, methods as also develop perspectives on the application of analytical methods to the study of environment.*

Desired outcome:

- *Learner shall develop skills in instrumentation used for the study and analysis of various substances related to the environment.*

4.1 Sampling: Various methods for gases, liquids and solids (Principles and applications only)

4.2 Analysis:

4.2.1 Classical Methods-Volumetric (Acid-Base; Redox, Complexometric titrations), Gravimetric.

4.2.2 Modern Methods -Spectroscopy

a) Absorption Methods-Colorimetry and Spectrophotometry, Turbidometry, Nephelometry, Atomic Absorption Spectroscopy, Fluorescence Spectrometry, X-Ray Absorption Spectroscopy, X-Ray Diffraction.

b) Emission Methods: Flame Photometry, Atomic Emission Spectroscopy.

4.2.3 Separation Methods

a) Extraction Techniques- Distillation, Solvent Extraction and Column Chromatography.

b) Chromatography- Gas Chromatography (GSC, GLC) HPLC.

c) Electrophoresis.

4.3 Interpretation and presentation- Introduction to the application of statistical tools and software.

Unit 5: Green / Environmental Audit

Objective:

- *To introduce the learner to the concept of green environmental audit.*

Desired outcome:

- *Learner and facilitator both will develop conceptual clarity on pollution control and green environmental auditing, besides gaining knowledge about these programmes in the Indian scenario.*

5.1 Concept & economics of pollution control.

5.2 Environmental accounting: definition, concept & issues.

5.3 Concept of environmental audit.

5.4 Benefits of environmental auditing.

5.5 Environmental audit programmes in India.

Unit 6: Industrial consultancy
Objective:

- *To expose and augment the avenues of employability and entrepreneurship in the arena of industrial consultancy.*
- *To ensure that the learner applies the learning gained during the under-graduate days for enhancing his skills and employability quotient in relevant industries.*
- *To develop an understanding of the MPCB norms and procedure for liaison.*

Desired outcome:

- *Learner and facilitator both will be exposed to the various areas and facets of industrial consultancy, and shall also develop competency and confidence to explore it.*
- *Learner will be able to grasp the importance of various norms required for MPCB permits and procedure for liaison.*

6.1 Types of consultancies.
6.2 Calculating consultancy fees.
6.3 Industrial marketing.
6.4 Logistic services for medical, microbiological, carcinogenic, toxic, nuclear waste.
6.5 MPCB and CPCB norms and liaison.

Unit 7: Neo Avenues
Objective:

- *To expose the learner to the array of environmental related domestic products with a view to develop, market and discover their application for the purpose of a better environment.*

Desired Outcome:

- *Learner will develop an acumen to tap the potential for entrepreneurship with respect to environment related products and indoor plants.*

7.1 Understanding market niche of domestic pollution control devices –air purifiers, smoke absorbers and chimneys, Heating, Ventilation and A.C. Systems (HVAC).
7.2 Green marketing:
  7.2.1 Greenhouse gas reduction market.
  7.2.2 LOHAS (Lifestyle Of Health and Sustainability) and Green Washing.
7.3 Indoor Plants to Reduce Pollution:
  7.3.1 Radiation absorbing plant, example – *Adiantum capillus-veneris* (Venus or Black Maiden hair fern)*, Ocimum sanctum* (Holy basil or Tulsi*), Hedera helix* (Ivy*).*
  7.3.2 Natural air filtering system, example – *Chlorophytum comosum* (Spider plant*), Monstera deliciosa* (Swiss cheese plant*)*
  7.3.3 Smoke absorbing plant, example – *Philodendron bipinnatifidum* (Lacy tree philodendron or Selloum)*, Dracena reflexa* (Song of India*), Dendrantehema grandiflora (*Chrysanthemum or Shevanthi*), Gerberajamesonii* (Transvaal daisy*)*

Unit 8: Case Studies and Simulations

Case Studies and Simulations is one of the eight units and hence may or may not be opted by the college. If opted, teachers in consultation with the students shall select the case studies for this unit every year, if required, and shall seek endorsement of the Head and the Principal.

Colleges/institutes have to select the topics as per their needs and available resources. It is pertinent to note that the case studies and simulations shall be operational and available in the syllabus only until it comes under the scope of internal assessment.

Objective:

- *To encourage abilities of learner to better understand the concepts.*
- *To develop better analytical abilities to assess varying dimensions while making decisions*.

Desired outcome:

- *Learner will comprehend and develop better acumen so as to, take wise and necessary decisions while participating in environment related projects or framing policies/assessing environmental damages/carrying out entrepreneurial activities beneficial to environment.*
- *Learner shall primarily learn to tackle real life situations with common sense.*

(Any eight from suggested below or more, developed by teacher)

8.1 Avhan- Disaster management model of the Chancellor.

8.2 Shirpur model of water conservation.

8.3 Powai lake conservation, Mumbai.

8.4 Fukushima Daiichi nuclear disaster, Japan.

8.5 Itai-itai disease for cadmium toxicity.

8.6 Chernobyl disaster.

8.7 Environmental Education in Finland – A Case Study of Environmental Education in Nature Schools.

8.8 An international environmental law case study: Bhopal Gas Tragedy.

8.9 Case Study on Green Building, Hotel Orchid- Ecotel.

8.10 Mumbai rain disaster of 26th July 2005.

8.11 Serial bomb blasts.

8.12 Tsunami at Andamans.

8.13 Govardhan Eco Village.

8.14 Planning development of prescribed land with constraint (Simulation).

8.15 Ralegan Siddhi / Hiware bazaar as model of environment conservation.

Semester V Practicals
Course Code USACEVS5P1

2 Credits

1) Study of Physico-chemical properties of sewage/ effluent water: conductivity, turbidity, dissolved oxygen, salinity & total hardness.
2) Estimation of Pollution: BOD &COD.
3) Microbiological parameters: MPN and Gram staining
4) Study of air micro flora.
5) Measurement of intensity of light by Lux meter.
6) Bioassay studies using water hyacinth or any suitable material.
7) Study of types of pollution: water, air, land.
8) Study of product derived by application of green chemistry (Laundry detergents, Polylactic acid packaging, Green paints, Pharmaceutical drugs- Ibuprofen)
9) Study of application of alternative energy resources (Solar panel, Biogas plant, Photovoltaic cell, Windmill, Nuclear reactor, Harnessing tidal energy)
10) Study of applications of various Spectroscopy (any 4), Chromatography and Electrophoresis instruments.
11) Study of logistic services for medical, toxic waste (Containers, Incinerator, Autoclave).
12) Study of indoor plants for reduction of pollution (*Adiantum, Ocimum sanctum, Ivy, Chlorophytum, Monstera, Philodendron, Dracena, Chrysanthemum, Gerbera).*
13) Photographic documentation of environment related issues/ conservation Submission of soft & hard copy of 5 original photographs taken by the learner (Exif details required)
14) Assignment (may be submitted in a group not exceeding three students).

Please refer to Annexure- I for suggested topics for assignment.

***Note- The practicals may be conducted by using preserved specimens/permanent slides authorised by the wild life and such other regulating bodies though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/simulations/ models etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in above.**

N.B:

I) It is pertinent to note that we have to adhere strictly to the directions as given in the UGC Circular F14-4/2006 (CPP-II).

II) Apart from the institutional Animal Ethics Committee (IAEC) and any other Committee appointed by a Competent Authority/Body from time to time, every college should constitute the following Committees:

1) A Committee for the Purpose of Care and Supervision of Experimental Animals (CPCSEA) and
2) A Dissection Monitoring Committee (DMC) to ensure that no dissections or mountings are done, using animals.

Composition of DMC shall be as follows:

i) Head of the Concerned Department (Convener/Chairperson)
ii) Two Senior Faculty Members of the concerned Department
iii) One Faculty of related department from the same College
iv) One or two members of related department from neighbouring colleges.

USE OF ANIMALS FOR ANY EXPERIMENT/DISSECTION/MOUNTING IS BANNED. SIMULATIONS, AUTHORISED PERMANENT SPECIMENS/SLIDES, CHARTS, MODELS AND OTHER INNOVATIVE METHODS ARE ENCOURAGED.

Semester VI: Theory
Environmental Management
Course code: USACEVS601

(Any four units to be opted)

Lectures 60
Credits 2

Unit 1: Business Analytics of Environmental Testing

Objective:

- *To explore business analytics of environmental testing and monitoring laboratories for research purposes and as career ventures*.

Desired outcome:

- *Learner will gain knowledge about environmental testing and monitoring laboratories, air, water quality and noise exposure standards and methods of physico-chemical and bacteriological sampling.*
- *Learner will be exposed to the know-how regarding establishing environmental testing and monitoring laboratories.*

1.1 Establishing environmental testing laboratory.
1.2 Methods of monitoring and control of air pollution. Air quality standards.
1.3 Physico–chemical and bacteriological sampling and analysis of water quality standards.
1.4 Measurement of noise and its indices. Noise exposure levels and standards.

Unit 2: Ecological restoration

Objective:

- *To focus the learner towards the immediate need to develop and practise the present and future systems, processes, technologies used for treatment of domestic waste water and industrial effluents.*
- *To seek and explore alternatives to conventional resources*.

Desired outcome:

- *Learner will study and comprehend the treatment practices applied for domestic waste water and industrial effluents.*
- *Learner will be equipped with the knowledge of some alternatives to conventional resources.*

2.1 Domestic waste water treatment.
2.2 Effluent treatment of Industrial waste.
2.3 Bioremediation.
2.4 Alternatives to conventional resources: biodegradable plastic, biodiesel, bio ethanol& bio pesticides.
2.5 Developing effluent treatments.

Unit 3: Impact Assessment through Ecological Modelling
Objective:

- *To introduce the learner to the concept of statistical modelling and neural networking.*
- *To direct and broaden the perspective of the learner to comprehend the importance of modelling while summarising the findings of research and survey data, or while accepting new applications in systems and processes.*

Desired outcome:

- *Learner will develop an understanding on the concept, application and limitation of modelling as a tool for summarising or applying the research and survey findings.*
- *Learner will develop skills on the application of neural networking and statistical modelling.*

3.1 Concept, applications and limitations.
3.2 Impact prediction with physical models.
3.3 Introduction to the concept of Artificial Neural Networking (ANN) and statistical modelling.

Unit 4: Finance
Objective:

- *To introduce the various concepts of costing, book keeping and final accounts.*

Desired outcome:

- *Learner will gain an insight into the basics of costing, book keeping and accountancy.*
- *Learner will be equipped to apply the concepts in his entrepreneurial ventures.*

4.1. Costing

4.1.1. Basic concept: Types of cost (historical, standard and managerial).
4.1.2. Budget: Budgetary control (process, batch, job and service).
4.1.3. Variances: Material, labor and overheads.

4.2. Basic accountancy:

4.2.1. Basic terms, golden rules in accounts, types of accounts (Indian), journal entry, ledger posting, subsidiary book, single column cash book, double column cash book.
4.2.2. Depreciation: fixed installment, reducing balance method.
4.2.3. Bank reconciliation.
4.2.4. Rectification of error.
4.2.5. Final account.

Unit 5: Biodiversity Conservation & Ecotourism
Objective:

- *To sensitize the learner towards the importance of conserving the existing biodiversity.*
- *To explore possibilities within learners to be nature enthusiasts, passionate naturalists, adventurists and eco friendly tourists.*

- *To tap the ecotourism avenues within and outside the country.*

Desired outcome:

- *Learner will develop aptitude to examine and assess the outcome of the framework of current biodiversity hotspots and biosphere reserves.*
- *Learner will be able to list the different aspects of wildlife photography and inspect the positive and negative aspects of it, also be able to recommend how wildlife photography can support biodiversity conservation.*
- *Learner will be able to assess the future challenges that ecotourism can generate for biodiversity conservation.*

5.1 Hotspots of biodiversity and biosphere reserve.
5.2 Strategies for biodiversity conversation (in-situ and ex-situ).
5.3 Commercial wildlife photography.
5.4 Ecotourism–definition, policies and practices.

Unit 6: Climate Change
Objective:

- *To awaken the learner towards focussing on the critical issue of climate change.*
- *To establish the impact of climate change, the greatest destabilizing force that undermines global economy, and threatens our health.*

Desired outcomes:

- *Learner will ponder upon and find out the what, why, where, whom and which of climate change and global warming.*
- *Learner will be able to identify and evaluate the effects of the different sources of greenhouse substances.*

6.1 Introduction to climate change, global warming and its effects.
6.2 Greenhouse substances: Sources & effects.
6.3 Geospatial technology- Remote Sensing & GIS.
6.4 Role of IPCC in climate change monitoring; Kyoto Protocol, Montreal Protocol, Earth Summit & UN Convention on Climate Change.

Unit 7: Environmental Education & Legislation
Objective:

- *To develop the knowledge and thinking ability regarding environmental issues. To help the learner to acquire a set of values for environment protection.*

Desired outcome:

- *Learner will imbibe positive changes in attitudes, commitments and civic actions required to combat harmful effects of anthropogenic activities and development on environment.*
- *Learner would inculcate ethical values and responsibilities towards protection of environment*.
- *Learner will be equipped to implement goals of environment protection.*

7.1 Goals, objectives & principles of environmental education.
7.2 Environmental education programmes in India.
7.3 Environmental organizations & agencies-CITES, EPA, IUCN & MAB.
7.4 Environmental laws in India: Wild life Protection Act, 1972, Water Prevention & Control of Pollution Act, 1974, Air Prevention & Control of Pollution Act, 1981, Environment Protection Act, 1986 & Biological Diversity Act, 2002.

Unit 8: Open Unit

Open unit is one of the eight units that may or may not be opted by the college. Teachers in consultation with the students shall define syllabus under this unit every year, if required, and shall seek endorsement of the Head and the Principal.

Colleges/institutes have to select the topics as per their needs and available resources. It is pertinent to note that the open unit shall be operational and available in the syllabus only until it comes under the scope of internal assessment.

Objectives:

- *To teach any one of the units prescribed in the syllabus with more details and in depth leading to specialization in the capsule of units selected.*
- *To incorporate the topics of special need of the area, that is otherwise not covered in the syllabus.*
- *To give scope to creativity and wisdom of a teacher who wants to deal with the latest developments in the subject without waiting for the university to revise the syllabus.*

Semester VI Practicals
Course Code USACEVS6P1

2 Credits

1) Study of soil microflora and determination of sedimentation rate.
2) Study of physical properties of soil: Temperature, moisture, & texture of soil.
3) Study of chemical properties of soil: pH, Organic matter and Calcium carbonate.
4) Detection of heavy metal cations : Zinc, Cadmium, Lead from soil sample.
5) Population analysis by Quadrant method & Line transect method.
6) Observation & study of indicator species.
7) Study of air &noise pollution monitoring device, geospatial instrument.
8) Study of any five biodiversity hotspots, bio reserves of India.
9) Study of any four effects of global warming and climate change.
10) Study of ANN chart and statistical model.
11) Study the role of environmental organisations and agencies (CITES, EPA, IUCN & MAB).
12) Study of environmental laws of India.
13) Problems on accounting/costing.
14) Study of microbes & plants used in bioremediation.
15) Study of biodegradable plastic products, bio pesticides brands.
16) Visit to any industry/laboratory/plant/national park and submission of report.
17) Project and submission of report (Project report may be submitted in a group not exceeding three students).

Please refer to Annexure- II for suggested Field Visits and Annexure III for suggested topics for projects for Course code USACEVS6P1.

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N.B:

I) It is pertinent to note that we have to adhere strictly to the directions as given in the UGC Circular F14-4/2006 (CPP-II).

II) Apart from the institutional Animal Ethics Committee (IAEC) and any other Committee appointed by a Competent Authority/Body from time to time, every college should constitute the following Committees:

1) A Committee for the Purpose of Care and Supervision of Experimental Animals (CPCSEA) and
2) A Dissection Monitoring Committee (DMC) to ensure that no dissections or mountings are done, using animals.

Composition of DMC shall be as follows:

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ii) Two Senior Faculty Members of the concerned Department
iii) One Faculty of related department from the same College
iv) One or two members of related department from neighbouring colleges.

USE OF ANIMALS FOR ANY EXPERIMENT/DISSECTION/MOUNTING IS BANNED. SIMULATIONS, AUTHORISED PERMANENT SPECIMENS/SLIDES, CHARTS, MODELS AND OTHER INNOVATIVE METHODS ARE ENCOURAGED.

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SCHEME OF EXAMINATION (THEORY & PRACTICAL)

(a) Internal assessment of twenty five (25) marks per course per semester should be conducted according to the guidelines given by University of Mumbai vide circular number UG/04 of 2014 Dated 5th June 2014 to be implemented from academic year 2014-15.

(b) External assessment of seventy five (75) marks per course per semester should be conducted as per the following skeleton question paper pattern.

(c) One practical examination of one hundred (100) marks per course each should be conducted at the end of every semester.

Modality of Assessment:
Theory Examination Pattern:

A) Internal Assessment - 25% 25 marks
Theory 25 marks

Sr. No.	Evaluation type		Marks
1.	Class test to be conducted as per following pattern		**20**
	a.	Match the column/Fill in the blanks/Multiple Choice Questions(1/2 mark each)	**05**
	b.	Answer in 1 or 2 lines(Concept based questions) (1 mark each)	**05**
	c.	Answer in brief (Attempt any 2 out of the 3) (5 marks each)	**10**
2.	Overall conduct as a responsible student, manners, attentive and inquisitiveness, skill in articulation, leadership qualities demonstrated through organizing co curricular activities, etc.		**05**

B) External examination - 75 %
Semester End Theory Assessment - 75% 75 marks

1) Duration - The examination shall be of two and half hours duration.
2) Theory question paper pattern:

a. Q1 shall comprise of 16 short notes (14 if case studies/open unit is not opted) representing all the units in the syllabus equally, of which students are expected to solve any five.

b. Q2 to Q9 (Q8 if case study/open unit is not opted) will be based on unit I to unit VIII of the syllabus respectively.

c. Q2 to Q9 (Q8if case studies/ open unit is not opted) shall have the following pattern.

A) 15 marks

OR

B) i) 7 marks
ii) 8 marks

Practical Skeleton Paper Course code: USACEVS5P1

Duration: 04 hrs **Maximum Marks: 100**

Q1.**Identification**:
20

Identify spots ‘a’ to ‘e’ as per instructions

a) Identify and describe the type of pollution.

b) Identify and describe the product derived by application of green chemistry.

c) Identify and describe the applications of bio analytical instrument / energy resource.

d) Identify and describe the type of logistic service.

e) Identify and describe the plant and its role in reducing pollution.

Major Experiment

Q2. Estimate Biological Oxygen Demand/Chemical Oxygen Demand from the given water samples (2) and submit the report. **25**

OR

Q2. Estimate the total acidity and total alkalinity of the given samples (2) and compare the results.
25

Minor Experiment

Q3. Estimate total hardness and turbidity/ conductivity of the given sample and submit a report. **15**

OR

Q3. Estimate total acidity/ alkalinity/ salinity of the given sample and submit a report**.** **15**

OR

Q3. Estimate Dissolved Oxygen from the given water sample and submit the report. **15**

OR

Q3. a. Determine the intensity of light using Lux meter. **08**

Q3. b. Estimate the conductivity of the given sample. / Determine the MPN of the given water sample. **07**

Q4. a. Submission of five environment related original photographs. **10**

Q4. b. Submission of assignment& viva based on it. **20**

Q5. Certified journal. **10**

Practical Skeleton Paper Course code: USACEVS6P1

Duration: 04 hrs **Maximum Marks: 100**

Q1.**Identification**: **20**

Identify spots ‘a’ to ‘e’ as per instructions

a. Identify and describe air / noise pollution monitoring device / geospatial instrument.

b. Identify and describe biodiversity hotspots / bio reserve marked on the map.

c. Give the full form of and describe the role of CITES/EPA/IUCN/MAB.

d. Identify the act from the given clause and comment on it / Identify and describe the effect of global warming or climate change.

e. Identify and describe ANN chart/ statistical model or solve the given problem.

Major experiment

Q2. Estimate organic matter content from the given sample and submit a report. **25**

OR

Q2. Estimate calcium carbonate content from the given sample and submit a report**.** **25**

OR

Q2. Investigate the given sample and report about the presence of any (or all) of the following heavy metal cations:- Zn (II)/Cd (II)/ Pb (II) from the given soil sample. **25**

Minor experiment

Q3. Analyse the texture and moisture content of the given soil sample and submit a report. **15**

OR

Q3. Analyse the texture and pH (pH paper, pH meter and universal indicator) of the given soil sample and submit a report. **15**

Q4. Project and viva based on it. **20**

Q5. Field report. **10**

Q6. Certified journal. **10**

ANNEXURES

Annexure I: Suggested topics for assignment USACEVS5P1

(Teachers are expected to develop additional innovative topics, varying every year, to be assigned to the students).

1. List out the instruments or funding agencies or permits required for setting up an environment testing laboratory.
2. Survey of NGO's working in the environmental field in your area.
3. Preparation of proposal for green building and sustainable development.
4. Prepare a cost sheet for setting up a bio degradable plastic unit.
5. Make an inventory of the water bodies presently existing/which existed in the urban/rural area of about 5kms.
6. Find out information regarding pollution testing booths that the Government proposes to set up.(List out the personnel who will man the booths and the indigenous equipment that these booths will have).
7. Make a report on amenities, trees, dimensions of open spaces in your locality. Assess their role in maintaining the ecological balance in the region.
8. Survey housing societies/institutions/organisations to find out whether they are converting household/kitchen waste into anything utilisable like vermicomposting etc.
9. Meet entrepreneurs involved with manufacture of eco-friendly products/best out of waste etc. Make a report regarding how the entrepreneur decided to pursue such an initiative, its need, the process and benefits to the environment.
10. Calculate carbon footprint of your family/class-room or laboratory/housing society by visiting the appropriate site on internet.
11. Visit architectural /horticulturist firms that deal with vertical gardening /urban farming and prepare a first-hand report on the concept, where implemented and the advantages.

All topics mentioned above are suggestive, more creative and innovative topics are expected from the students, under the able guidance of the concerned teacher, to suit the expertise, human resources, infrastructure and local needs as also the interest of the students.

The assignment may be submitted in a group not exceeding three students.

Annexure II: Suggested Field Visits USACEVS6P1

- There shall be various short and long excursions / study tours / field visits / industrial visits in every semester, at least one of which shall be financially affordable to every student in the class; and that assessment and marks of field trips shall be solely based upon such where no student was restrained for financial limitations.
- Field visits are to be organized to facilitate students to have firsthand experience & exposure to technology/production/functioning of organization/units or witness a relevant activity.
- Each student must make at least 01 (one) such visit to the units/treatment plants/aquatic or terrestrial habitat organized by the College.
- The list is suggestive and not exhaustive.

1. Visit to Sewage treatment plant.
2. Visit to Vermicomposting unit.
3. Visit to Air Monitoring Laboratory.
4. Visit to Environment Pollution Detecting Laboratory.
5. Visit to Cooling towers in industries.
6. Visit to Rain Water Harvesting System.
7. Visit to Biogas Plant.
8. Visit to Green Building/Ecotel Hotel.
9. Visit to Water Filtration Plant.
10. Visit to office of Pollution Control Board.
11. Visit to Greenhouse.
12. Visit to Solid Waste Management Plant.
13. Visit to hydro/thermal power plants.
14. Visit to Environmental Agencies-CITES
15. Visit to National Parks, Sanctuaries, Biosphere Reserves etc. in Maharashtra/India/abroad.
16. Visit to NEERI.
17. Visit to Enviro Vigil, CSM Hospital Campus, Kalwa (W), Thane.

Annexure III: **Suggested Topics for Projects USACEVS6P1**

(Teachers are expected to develop additional innovative topics, varying every year, to be assigned to the students).

1) Effects of anthropogenic activities on different ecosystems; for example mangroves/ wetlands.
2) Effect of tourism activities on different ecosystems.
3) Assessment of ecotourism potential-SGNP, different sanctuaries.
4) Water audit in your area.
5) Costing, accounting & budgeting of eco-friendly idols during festivals.
6) Costing, accounting & budgeting for paper making from waste.
7) Study the role of microbes in biodegradation of: plastic, pesticides, heavy metals, hydrocarbons, etc.
8) Preparation of feasibility Report of eco-friendly products.
9) Preparation of feasibility report of environment testing laboratory.
10) Preparation of feasibility report for manufacture of any domestic pollution control device.

The project may be submitted in a group not exceeding three students.

Annexure IV: Learners' space

When the education system today has identified special needs of slow learners we are still silent about needs of high IQ students. Teachers are therefore recommended to identify and encourage such students to undertake research with a view to publish paper/s in peer reviewed International Indexed Journals with high impact factor thus providing 'learners' space'.

Some of the suggestive avenues are listed below which are certainly not exhaustive since the said students under the guidance of teachers can identify latest areas of research. Needless to say that 'learners' space' is an optional additional activity which may not be undertaken by college if not befitting.

1. Effluent analysis for heavy metals with speciation.
2. Environmental impact due to monsoon runoff from farms containing pesticides.
3. Ecological modelling of a water body.
4. Environment impact assessment of human activities.
5. Heavy metals accumulation and transfer to all three trophic levels.

Annexure V: Play and Ponder

While learner's space is for high IQ Students, 'Play and Ponder' could be a general activity creating interest in the subject and could also be a part of pedagogy wherein it may be considered as innovative teaching methodology. Needless to say that 'Play and Ponder' again is not mandatory and is an additional activity if desired by the students.

Following are some suggestive activities though of course teachers can creatively develop more, each year, to be assigned to the students.

1. Make a compost heap for your garden by recycling household wastes.
2. Make a bird feeder from waste plastic bottles.
3. Create your own organic garden.
4. Make a model of a natural cooling system and study its effectiveness.
5. Make your own recycled paper and create handmade crafts from it.
6. Make a self-sustaining closed ecosystem viz. bottle garden/aquarium ecosphere.
7. Make a model for harvesting rain water in your house/building.
8. Prepare your own solar oven.
9. Place a bird feeder in your garden and evaluate whether it really helps birds that need conservation?

Model Question Paper USACEVS501

Duration 2.5 hrs **Maximum Marks: 75**

N.B.: 1. Q 1 is compulsory.
2. Attempt any four questions from Q 2 to Q 9.
3. Draw neat and labelled diagrams wherever necessary.

Q1. Write short notes on any **five** of the following (Mixed questions from all units): **15**

a. Zones of atmosphere
b. Soil profile
c. Significance of green chemistry
d. Concept of sustainable development
e. Sources of noise pollution
f. Petro crops
g. Application of flame photometry
h.Application of gas chromatography
i. Concepts of environmental accounting
j. Concept of environmental auditing
k. Logistics services for medical waste
l. MPCB norms
m. *Adiantum*, as a radiation absorbing plant
n. Green washing
o. _____ (from case study, if opted)
p. _____ (from case study, if opted)

Q 2. **Question based on Unit 1**

Describe the various segments of lithosphere and biosphere. Comment on their composition and inter- relationship. **15**

OR

2a. Describe the various sources of water pollution. Add a note on effect of pesticides on aquatic ecosystem**.** **8**

2b. Explain the challenges posed by present day gaseous air pollutants on environment. **7**

Q3. **Question based on Unit 2**

What are the principles of sustainable development? Give a detailed account of sustainable development indicators **15**

OR

3 a. Comment on the areas highlighted in Agenda 21**.** **8**

3 b. Comment on green economy. **7**

Q4. **Question based on Unit 3**

Give a detailed account on solar energy, wind energy and tidal energy as an

alternative energy resource. **15**

OR

4 a. Nuclear energy, a boon or a curse. Discuss. **8**

4 b. Explain the use of solid waste as a source of energy. **7**

Q5. **Question based on Unit 4**

Explain different types of Spectroscopy. Discuss the application of X-ray diffraction. **15**

OR

5 a. Describe the application of statistical tools and software in field of environmental science**.** **8**

5 b. Discuss the application of electrophoresis as separation technique. **7**

Q6. **Question based on Unit 5**

Explain the concept and economics of pollution control. Add a note on Environmental accounting. **15**

OR

6 a. Write a note on Environmental audit programmes in India. **8**

6 b. Comment on the benefits of environmental auditing. **7**

Q7.Question based on Unit 6

Explain the types of industrial consultancies and add a note on industrial marketing. **15**

OR

7 a. Discuss the criteria for calculating industrial consultancy fees? **8**

7 b. Describe the norms and procedures related to MPCB liasioning. **7**

Q 8. **Question based on Unit 7**

Explain the marketing of Heating, Ventilation and A.C. systems and air purifiers as domestic pollution control devices. **15**

OR

8 a. Discuss the concept of Green washing giving suitable examples**.** **8**

8 b. Describe *Chlorophytum* as a natural air filtering system. **7**

Q 9.**Question based on Unit 8**

Question based on case study/ simulation (if opted). **15**

A paper on disaster management was presented at the International Conference on 'Urban Planning and Environment Strategies and Challenges' organized by Elphinstone College, Mumbai in the year 2007. It was picked up by the then DDG, Maharashtra NCC, Brigadier Shard who contacted the author, Vinayak Dalvie, Joint secretary to the Governor through an ANO, insisting him to implement the model through NCC. The then Secretary to the Governor, Shri Sitaram Kunte convened a meeting of NCC officials with the Governor H.E. Shri S.M.Krishna for presentation on Avhan by Shri Dalvie. The Governor immediately issued necessary orders integrating NCC, universities and the government disaster management agencies. Based on the modalities, Colonel Samuel from Pune worked out the first training camp at Shivaji University, Kolhapur.

The said model proposes a self-sufficient and strategic training and capacity building of University students, mainly NCC cadets, for disaster management, who can, on call reach any nook and corner of the State instantaneously along with equipment and resources of their own from a self-generated fund.

A platoon of 30 cadets (20 boys+10 girls), preferably from first year NCC to make the said trained force available for two more years, selected from each district of the State shall be trained by the host University from 22nd May to 5th June (Paryavaran Diwas) every year in the areas of administration, medical and operations simulating various natural and manmade disasters with an emphasis on practical approach. Each heading has twelve modules. 36 specialised resource persons would be deputed in the camp for 12 days, each addressing a district platoon at a given point of time in rotation as per the scheduled time table. Three cadets from each district, portraying the best performance; one each in administration, medical and operations respectively will be selected for Phase II training during the Diwali vacation. Thus three platoons of 36 cadets each are formed to receive special inputs at places like Yashada and JBIMS for administration; INS Ashwini, AFMC, MUHS for medical; Home guards, Civil defence establishments and Army for operations respectively. After Phase II training each district has a platoon of 30 cadets with three section I/C to take a lead role equipped with special training in administration, medical and operations. This platoon can reach the site of disaster within an average of two hours on receiving communication from the concerned ANO. During the academic year, every platoon will perform practice drills in each taluka to raise awareness in the common man, who is the first responder in any disastrous situation. Further, manpower of trained 1000 cadets can reach within a day from the remaining districts of Maharashtra. One Associate NCC officer from each district will also be trained in the course who can take charge of the situation.

This trained force called Chancellor's brigade would come into operation only on call from a disaster management authority playing a complimentary role and coming into action immediately since funds are made available by the local Vice Chancellor within an hour.

Each University can purchase basic necessary equipment and build infrastructure from the interest earned on the corpus fund collected for last few years by charging Rs. 10/- to each student as disaster management fund every year. The host University can

arrange for the training of 1000 cadets also from the same funds. The host University may also receive approximately Rs.60 lakhs @ Rs.2/- per student out of Rs.20/- collected each year as Ashwamedh fund from all students. The local Vice Chancellor, concerned ANO and NCC officer shall prepare a budget based on estimated need. Financial decisions can be taken by a committee of three Vice Chancellors i.e. of the previous, the current and the next host University over telephone/e-mail/fax to be endorsed by the Secretary to Governor or in his absence the next officer in hierarchy for easy disbursement, on call, to the Vice Chancellor in whose jurisdiction falls the district facing the disaster. The Vice Chancellor of host University shall reimburse the said amount from surplus in Rs. 60 lakhs after the cost of training camp which is about Rs.30 lakhs.

Since the concerned ANO and NCC officer are empowered to purchase ration, medicine and utilities as per the pre sanctioned rate charts, Chancellors brigade comes into action instantaneously with no financial burden on the Government thus befitting the motto 'Swayam purna Swayamsiddha Samarth'.

Q1. The present model is not being effectively implemented in real life situations. What are your suggestions?

Q2. Plan a training schedule for 12 days in all the modules.

Q3. Enlist possible modules under each head.

OR

Shirpur Model- 'Angioplasty in Water Conservation'

Shirpur model gets its name from the place Shirpur, a taluka in Dhule district of North-East Maharashtra. Once an obscure and drought-hit region, it is now referred to as 'Green taluka'. Shirpur taluka has a geographical area of 837.39 sq.km. About 78.07% of this is cultivable of which only 12.94% is under irrigation. This area receives an annual rainfall of 617 mm in over 36 days with most water draining into the river Tapi. The distribution of rainfall is highly erratic and the surface water resources are hence unevenly distributed. As a result of this, the use of groundwater for irrigation, drinking, and industrial purposes has increased many fold. The main cash crops in Shirpur are sugarcane, cotton and banana which rely heavily on ground water for irrigation.The soil in Shirpur is partly of Tapi alluvium type and partly Deccan Basalt type. Alluvium consists of alternate layers of clay and sand, gravel and boulders of variable thickness. The effective porosity of sand bed in Tapi Alluvium is about 30%. In Basalt, alternate layers of weathered basalt and hard massive basalt is observed. The porosity in the Basalt is about 2-3% and wells dug in Basalt hardly saturate. The saturated sand beds cater to the needs of drinking water and irrigated agriculture mainly cash crops. Indiscriminate withdrawal and overexploitation of this source to meet these needs resulted in the decline of ground water level and led to acute water shortage. All the dug wells in Tapi alluvium in Shirpur became dry by 1990. Even tube wells having a depth of about 200-500 meters became dry. Alternate layers of silt transmit very little water and the wells remain dry in heavy rainfall also. In the Basalt area, due to heavy

rainfall within short duration, there was only run off with hardly any percolation. That is why dug wells and bore wells in Deccan Basalt hardly yielded water maximum up to December. There was severe scarcity after December for drinking water as well as for irrigation. As a result, the huge amount invested on dug wells, pump sets and other development works by the individual farmers became futile. The most affected were the bore wells drilled for drinking water and situated in the elevated regions. With increased use of groundwater for irrigation, bore wells were drilled in the close proximity of the drinking water bore wells. This resulted in drying up of drinking water wells in manyparts of the taluka. Thus, drying of wells and tube wells in alluvial area and insufficient availability of water after December in the Deccan Basalt area were the main problems of Shirpur Taluka. There was an urgent need to take suitable measures to augment groundwater resources and to make the existing groundwater structures sustainable.

Troubled by acute water shortage crisis, the local MLA Shri Amrish Patel wanted to use rain water conservation methods to meet the water demands of the taluka. He along with geologist Shri Suresh Khanapurkar devised a plan to trap this rain water and started the project in 2004.Patel set aside Rs 3 crore every year for this ambitious project. To overcome the water shortage it was necessary to ensure that the ground water levels were fully saturated in spite of erratic rainfall and impervious layers in Alluvium and Deccan Basalt. The plan included three measures:

1.Building of cement structures (bundhs) on streams, with weirs (water blocking walls on streams) without gates, so that water flows downstream, only when the dam is full. The volume of water that percolates down in this method is eight times the storage capacity of a check dam.

2. To deepen the stream up to15 to 20 metres and widen up to 30 metres in Deccan Basalt and Alluvium.

3.To recharge the deeper layers in the Alluvial area using the surplus water of the dams in the Deccan Basalt area artificially through the dry dug wells having depth of about 40 to 50metres.

To ensure the success of the plan, a novel method to build the check dam was adopted. The Deccan Basalt rock that lies below the top soil is impermeable and not much water percolates down. Below this, is the layer of red gravel that holds water. It is this water that is drawn from wells and bore wells. The rock layer below the streams was blasted and removed so that water could percolate into the gravel. Since the stream was also widened, the increased volume of water exerted greater pressure on the soil. The volume of water that percolates down in this method is eight times the storage capacity of a check dam. Shri Khanapurkar calls this ‘Angioplasty of streams’, as it is recharging groundwater by removing obstructions through pressure.

The methods adopted proved to be successful and yielded encouraging results. The water level in Basalt area which had depleted up to 150 metres has risen by 140metres. Water level in alluvial area which had depleted up to 150 metres has risen by 110 metres. A minimum of 5 crore litres and a maximum of 15 crore litres of water has been stored because of stream widening and deepening. As a result of this the water level in the bore wells on either bank of the stream up to two km distance

went up by about 150 feet. Drinking water problem has been solved. The area for irrigation has increased and farmers started growing two crops per year. The average per capita income has increased at least by Rs one lakh/Ha. After completion of the 6thyear of the project, sufficient water for irrigation, drinking and for industries is available even in summer.

Shri Amrish Patel (MLC), former Minister of Education, Govt of Maharashtra, and President of Shri Vile Parle Kelvani Mandal feels that Shirpur pattern has innumerable advantages, "There is no need to displace people. The capital cost is low. So far, we have built 91 check dams at a cost of Rs 15 crore. Total water conserved due to these dams is 400 million cubic feet (mcf). If a medium scale dam with this much storage capacity was to be built, it would cost Rs 61 crore." 'If Angioplasty In Water Conservation' is practised on all small streams in all the mini and micro watersheds, entire Maharashtra will be tanker free and water will be available for second crop" claims Mr Amarishbhai, who has a legacy of belonging to the family of Vallabhbhai Patel.

However, Dr.Mukund Ghare, a groundwater expert in Maharashtra, Sourabh Gupta, scientist with the Central Groundwater Board, and Suresh Khandale, Additional Director of GSDA, Pune, felt that the width and depth of a stream gets decided as per the hydro-geology of that area and that deepening the stream bed by 15-20 meters exposes the aquifers which come in contact with muddy rain waters, clogging the aquifers and stopping the flow. Dr Ghare mentioned in his report submitted to the Govt of Maharashtra that deepening the stream beds more than what is required can lead to environmental problems and in basalt areas, the aquifers have become exposed; water has come to surface and is getting evaporated. Shirpur model, however, got support from the Government of Maharashtra which issued a Government Resolution (GR) on 9 May 2013 to replicate the Shirpur model all over Maharashtra.

Himanshu Kulkarni of ACWADAM, a premier NGO working on groundwater, warns that if the Shirpur model is taken up for large scale replication then it can lead to short and long term negative impacts, and some of them could be irreversible. It can play havoc with the hydro-geology of the region threatening the sustainability of stream/river flows. It also raises questions of equity and access to downstream.

While it is true that we need to understand the concept of groundwater well, it is also a fact that sustainable agriculture needs water. If there is no water for years together, any option that will work and give water in the immediate future, even though it could potentially cause harm many years later, is employed by farmers. By now Shirpur model has been accepted by many villages in Maharashtra. A local organisation called Jan Kalyan Samiti operates in the area of Latur-Beed and has implemented Shirpur pattern structures through Gram Panchayats of several villages in the area. People are coming together and are willing to be monetary stakeholders.

Q1. Elucidate the main features of water conservation based on the Shirpur pattern.
Q2. Is the Shirpur model a viable solution in your opinion? Discuss.

Note: Questions of the model question paper are not exhaustive, but suggestive, and teachers have liberty to reframe, modify and add other questions as deemed fit.

Model Question Paper USACEVS601

Duration 2.5 hrs **Maximum Marks: 75**

N.B.: 1. Q 1 is compulsory.
2. Attempt any four questions from Q 2 to Q 9.
3. Draw neat and labelled diagrams wherever necessary.

Q1. Write short notes on any **five** of the following (Mixed questions from all units): **15**

a. Air quality standards
b. Most Probable Number (MPN) Count
c. Bioremediation
d. Bio pesticides
e. Concept of ecological modelling
f. Applications of ecological modelling
g. Depreciation.
h. Fixed and Variable cost giving 2 examples each.
i. Importance of biosphere reserve
h. Western Ghats as biodiversity hotspot
k. Remote sensing and its types
l. Kyoto protocol
m. Wildlife Protection Act, 1972
n. IUCN
o. ——— (from open unit, if opted)
p. ——— (from open unit, if opted)

Q 2.Question based on Unit 1

Give a detailed account on the methods of monitoring and control of air pollutants. **15**

OR

2 a. Discuss the noise levels generated from various sources. **8**

2 b. Discuss the factors to be considered while establishing an environmental testing laboratory. **7**

Q3.**Question based on Unit 2**

Discuss any two alternatives to conventional resources studied by you. **15**

OR

3a. Describe the process to treat domestic effluents**. 8**

3 b. Explain the process of developing effluent treatment plants. **7**

Q 4.Question based on Unit 3

Explain the concept of ANN (Artificial Neural Networking) and Statistical modelling. **15**

OR

4 a. Comment on the application of physical models for impact prediction**. 8**

4 b. Discuss the limitations of ecological modelling**. 7**

Q5. **Question based on Unit 4**

From the books of accounts of M/s Avdhoot Enterprises, the following details have been extracted for the Quarter ending December, 2016:

Particulars	Rs.
Stock of Materials – Opening	2,70,000
Stock of Materials – Closing	3,00,000
Purchase of materials	12,48,000
Direct Wages	3,57,600
Direct Expenses	1,20,000
Indirect Wages	24,000
Salaries to Administrative Staff	60,000
Carriage Inward	48,000
Carriage Outward	37,500
Manager's Salary	72,000
General Expenses	37,200
Legal Expenses for criminal suit	20,000
Commission on sales	28,000
Fuel	96,000
Electricity charges (factory)	72,000
Directors' fees	36,000
Repairs to plant and machinery	63,000
Rent, rates and taxes – factory	18,000
Rent, rates and taxes – office	9,600

Depreciation on Plant & Machinery	45,000
Depreciation on Furniture	3,600
Salesmen's Salary	50,000
Audit fees	18,000

1) The Manager's time is shared between the factory and office in the ratio of 20:80
2) Carriage Outward includes an amount of Rs. 7,500/- carriage inward on Plant & Machinery.
3) Selling price is 120% of cost price.

From the above details prepare the detailed cost sheet for the quarter ended December, 2016 and ascertain sales.

OR

5 a. Write briefly on types of costing, viz; job, batch, process, operating and contract costing. **8**

5b. Write short notes on: **7**

i.Types of accounts and the accounting rules applicable to each of them.

ii. Concepts of accounting.

Q6. Question based on Unit 5

What is Biodiversity? Explain in situ and ex situ strategies for biodiversity conservation. **15**

OR

6 a. Comment on wildlife photography as a tool for biodiversity data collection. **8**

6 b. Elucidate with an illustration the ecotourism policy in India. **7**

Q7. Question based on Unit 6

Discuss climate change. Give a detailed note on global warming and its effects on environment**.** **15**

OR

7 a. Explain the principles and applications of GIS. **8**

7 b. Comment on the UN convention on Climate change. **7**

Q 8.**Question based on Unit 7**

Discuss environmental education programmes in India. **15**

OR

8 a. Explain the goals and principles of environmental education. **8**

8 b. Discuss the Water (Prevention and Control of Pollution) Act, 1974. **7**

Q9. **Question based on Unit 8**

Question based on open unit (if opted) **15**

OR

9 a. _____ **8**

9b. _____ **7**

Note: Questions of the model question paper are not exhaustive, but suggestive, and teachers have liberty to reframe, modify and add other questions as deemed fit.