

# SHIVAJI UNIVERSITY, KOLHAPUR.



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(2014) with CGPA-3.16

Syllabus For

**Diploma in Industrial Pollution and waste water treatment technology**

Syllabus to be implemented from June 2014

**Shivaji University, Kolhapur**  
**Syllabus For**  
**Diploma in Industrial Pollution and waste water treatment technology**

1. **TITLE :** Diploma in Industrial Pollution and waste water treatment technology
2. **YEAR OF IMPLEMENTATION:-** New Syllabus will be implemented from June 2014 onwards.
3. **PREAMBLE:-**

The country needs more 'skilled' workforce in many different industries. In fact, majority of the contemporary institutions of higher learning remain almost disconnected with the requirements of the workplace. The skill oriented courses available in the market have low credibility and acceptability with the employers. The 12th Five Year Plan Document of the Planning Commission of University Grants Commission has laid a special emphasis on expansion of skill-based programmes in higher education. The proposed employment oriented Diploma course is designed under Community Colleges scheme of UGC.

This syllabus is framed to give sound knowledge with understanding of industrial sector pollution problems and waste water treatment technologies to the students at Diploma course. The goal of the syllabus is to implement career oriented education and skills to students interested in directly entering the industrial workforce. This course will save time and money of industries in training the students. The new syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the needs of industries and research. The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

**4. GENERAL OBJECTIVES OF THE COURSE:**

1. To make the students knowledgeable with respect to the subject and its practicable applicability.
2. To promote understanding of basic and advanced concepts in Industrial pollution aspects and waste water treatment technologies.
3. To expose the students to different processes used in industries and in research field.
4. To develop skills required in various industries, research labs and in the field of human health.
5. To prepare the students to accept the challenges in industrial sectors.

5. **DURATION:** The course shall be a full time course of 1 year.

6. **PATTERN:-** Pattern of Examination will be credit based semester pattern. The theory exam will be conducted semesterwise but the practical examination will be conducted at the end of year (i.e. annual pattern).

**7. ELIGIBILITY FOR ADMISSION:-**

The candidates must have passed 10+2 from Science stream or equivalent thereto.

**8. MEDIUM OF INSTRUCTION:**

The medium of instruction shall be in English.

**11. STRUCTURE OF COURSE:**

(Note – The structure & title of papers of the degree as a whole should be submitted at the time of submission/revision of first year syllabus.

Total Number of Theory Papers – 2/semester  
Syllabus

Sr. No.	Subject	Credits
<b>THEORY</b>		
Semester-I		
1	Paper I: Fundamentals of Environmental pollution	06
2	Paper II: Environment protection and related laws	06
Semester-II		
3	Paper III: Bioremediation	06
4	Paper IV: Waste Water Treatment Technologies	06
Total		24
<b>Skill acquisition</b>		
5	Practical course	24
6	Field visits/Training	12
Total		36
<b>Grand Total</b>		<b>60</b>

**12. SCHEME OF TEACHING AND EXAMINATION:-**

The scheme of teaching and examination should be given as applicable to the course/paper concerned.

Sr. No.	Subject	Teaching scheme (Hrs/week)			Exam scheme/ marks		
		L	T	P	Theory	Term work	Total
1	Paper I: Fundamentals of Environmental pollution	3			50	-	50
2	Paper II: Environment protection and related laws	3			50	-	50
3	Paper III: Bioremediation	3			50		50
4	Paper IV: Waste Water Treatment Technologies	3			50		50
5	Practical course			20	200	-	200
6	Industrial Training report				50		50
	Total			32			450

**13. SCHEME OF EXAMINATION:-**

- The examination shall be conducted at the end of each semester.
- The Theory paper shall carry 50 marks.

- Question Paper will be set in the view of the /in accordance with the entire Syllabus and preferably covering each unit of syllabi.

**Practical evaluation scheme is as follows:**

Industrial training shall carry 100 marks where internal examiner must evaluate the performance as acquisition of practical skills.

Practical examination will carry 100 marks where internal and external examiners must evaluate the performance being an applied course.

Marks obtained by the student will be converted into credit points.

**14. STANDARD OF PASSING:-**

35% passing in both theory and practical examinations separately.

**15. NATURE OF THEORY QUESTION PAPER AND SCHEME OF MARKING:-**

(Unit wise weightage of marks should also be mentioned)

2 Hrs. 50 marks.

Note: 1) Q. 1 is compulsory

2) Any four from the remaining

Question 1 Multiple Choice Questions (Ten)	10
Question 2 Explain in brief (any one) Two questions	20
Question 3 Write short notes on (any four) six notes.	20

Evaluation of the theory papers by external examiners in CAP Practicals

Evaluation of the practical examination done by external and internal examiners

Evaluation Industrial training report by external examiners from industry

**NATURE OF PRACTICAL QUESTION PAPER AND SCHEME OF MARKING:-**

Mentioned at the end of practical syllabus.

**16. EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAPERS- (FOR REVISED SYLLABUS)**

Not applicable.

**17. SPECIAL INSTRUCTION, IF ANY.**

- 1) Twenty day industrial training compulsory.
- 2) Compulsory field visits to different industries to study waste management.

NEW SYLLABUS FOR  
**Diploma in Industrial Pollution and waste water treatment technology**  
(Introduced from June 2014 onwards)

**THEORY**

**Paper I: Fundamentals of Environmental pollution**

**UNIT – I**

Lectures -20

**Basics of Environmental sciences**

Definition and meanings of terms-

Pollution, Abatement, Atmosphere, Gaseous emissions, Climate change, Composting

7. Conservation

8. Disposal

9. Ecosystem

10. Effluent

11. Environment

**UNIT – II**

**Environmental pollution:**

Lectures -25

Sources, causes and effects of

A. Soil pollution

B. Water pollution

C. Air pollution

D. Noise pollution

**UNIT – III**

Lectures -20

**Basics of Environmental pollution**

Meanings of some important terminologies

1. Global warming

2. Acid rain

3. Algal blooms

4. Carbon footprint

5. Green house effect

6. Hazardous waste

7. Incineration

8. Landfill

9. Oil spill

10. Ozone depletion

11. Particulate matter

12. Radiation

**UNIT – IV**

Lectures – 25

**General characteristics of waste:**

- A. Liquid waste - pH, electrical conductivity, COD, BOD, total solids, total dissolved solids, total suspended solids, total volatile solids, chlorides, sulphates, oil & grease.
- B. Solid waste- pH, electrical conductivity, total volatile solids, ash.
- C. Standards as per MPCB.

## **Paper II: Environment protection and related laws:**

### **UNIT – I**

**Important terminologies related to Environmental laws:** Lectures –20

Acceptable daily intake (ADI), Action levels, Active ingredient, Air mass, Air emission, Air stripping, Ambient air, best available technology (BAT), best management practices (BMP), Community waste water system, etc

### **UNIT – I I**

**Environmental laws:** Lectures –25

1. The water (Pollution and control of pollution) Act, 1974
2. The air (Pollution and control of pollution) Act, 1981
3. The environmental (Protection) Act, 1986

### **UNIT – III**

Lectures - 20

#### **Environmental Impact assessment:**

- A. Need
- B. Scope
- C. Steps
- D. Techniques

### **UNIT – IV**

Lectures - 25

#### **Characteristics and treatment of wastewater generated by:**

- a) Sugar Industry.
- b) Distillery Industry
- c) Dairy Industry
- d) Paper and pulp industry
- e) Textile industry

#### **Books Recommended:**

1. Environmental Pollution by Chemicals - Walker, Hulchison.
2. Biochemistry and Microbiology of Pollution - Higgins and Burns.
3. Environmental Pollution - Laurent Hodge, Holt.
4. Waste Water Treatment - Datta and Rao (Oxford and IBH).
5. Sewage and waste treatment - Hammer
6. Environment and Metal Pollution - Khan (ABD Pub. Jaipur).
7. Environment Pollution - Timmy Katyal (Satke Anmol Pub. New Delhi).

8. Environment Pollution and Management of waste waters by Microbial Techniques - Pathade and Goel (ABD Pub. Jaipur).
9. Current Topics in Environmental Sciences - Tripathi and Pandey (ABD Pub. Jaipur).
10. Environmental Impact Assessment - R. K. Trivedi

### **Paper III: Bioremediation**

#### **Unit I**

##### **Important terminologies in Bioremediation (20 Lectures)**

1. Contaminant, Xenobiotic, Remediation, Bioaccumulation, Biomagnification, Bioaugmentation, Bioavailability, Bioventing, Consortium, Enrichment, Inoculum, Mineralisation, Phytoaccumulation, phytoextraction, Recalcitrant, Rhizosphere.

#### **Unit II**

##### **Bioremediation and biodegradation: (20 Lectures)**

1. Bioremediation-concept,types- in situ and ex situ bioremediation.
2. Biodegradation- concept. Factors affecting the process of biodegradation.

#### **Unit III**

##### **Biotransformation: (25 Lectures)**

1. Xenobiotics- concept, Persistence and biomagnification of xenobiotic molecules.  
Use of microbes and plants in biodegradation and Biotransformation.
2. Sources and effects of heavy metal pollution, Microbial biosorption Biotechnology.
3. Concepts of Bioaugmentation and Biostimulation.

#### **Unit IV**

**(25 Lectures)**

##### **Water pollution monitoring:**

Methods of monitoring:

1. Biological methods- Detection methods for DO, BOD, Pathogen monitoring by heterotrophic plate count, multiple tube method.
2. Chemical methods- Detection methods for COD, pH, TSS, TDS,MLSS,MLVSS, etc



## **Paper IV: Waste Water Treatment Technologies**

### **Unit I**

**Important terminologies in waste water treatments systems:** (20 Lectures)

Sludge, aerobic treatments, anaerobic treatments, bioengineering, biosolids, clarifiers, sewers, wetland, retention time, disinfection, influent, effluent, scum, anaerobic digestion, trickling filter, root zone treatment technology.

### **Unit II**

(25 Lectures)

**Sewage and waste water treatments systems:**

- A. Primary treatment methods
- B. Secondary treatment methods and
- C. Tertiary treatment methods

### **Unit III**

(20 Lectures)

**Biotechnological application of hazardous waste management and management of Resources:**

1. Use of microbial systems.
2. Waste water treatment using root zone treatment by plants.
3. Reclamation of wasteland: biomass production for Biogas.

### **UNIT IV**

(25 Lectures)

**Sludge disposal:**

Sources and effects of sludge on environment.  
Methods of sludge disposal.

### **Books Recommended:**

1. Biotreatment Systems , Volume II ; D.L. Wise.
2. Advances in Biotechnological Process ; Mizrahi & Wezel.
3. Biodegradation and Bioremediation. Academic Press; 2<sup>nd</sup> edn. Martin Alexander.
4. Gabriel Bitton (Author). Wastewater Microbiology, 2nd Edition. Wiley-Liss; 2<sup>nd</sup> edition (February 16, 1999).
5. Milton Wainwright. An Introduction to Environmental Biotechnology. Kluwer Academic Publishers, Boston. Hardbound, ISBN 0-7923-8569-1. July 1999, 192.

## **PRACTICAL COURSE**

### **PRACTICAL COURSE-I**

Lectures 180

1. Study of laboratory equipments and instruments.
2. Study of compound microscope.
3. Cleaning and sterilisation of glass wares.
4. Determination of physical parameters of waste water
  - I. Temperature
  - II. Colour
  - III. Odour
  - IV. pH
5. Determination of total solids , volatile solids and fixed solids of waste water
6. Determination of nitrogen from waste water
7. Determination of phosphorus from wastewater
8. Determination of E.C. of wastewater
9. Determination of turbidity of wastewater
10. Determination of chlorides of wastewater

### **PRACTICAL COURSE-II**

Lectures 180

1. Determination of alkalinity of waste water
2. Determination of dissolved oxygen from waste.
3. Determination of biological oxygen demand (BOD) of wastewater
4. Determination of chemical oxygen demand ( COD) of wastewater
5. Determination of oil and grease from wastewater
6. Preparation of microbial culture media and its sterilisation.
7. Techniques of microbial culture cultivation
8. Determination of faecal contamination of water- qualitative and quantitative estimation.
9. Determination of SPC of different wastes.
10. Determination of quality of lime
11. Determination of flow rate.

### **FIELD VISITS:**

Lectures 120

1. Visit to Composting sites.
2. Visit to Vermiculture sites.
3. Visit to sewage treatment plants.
4. Visit to Common effluent treatment plants.
5. Visit to effluent treatment plants of- Sugar industries: 02
6. Visit to effluent treatment plants of- Textile industries
7. Visit to effluent treatment plants of- Distillary industries
8. Visit to effluent treatment plants of- Dairy industries

9. Visit to effluent treatment plants of- Pharmaceutical industries:02
10. Visit to Maharashtra pollution control board

**INDUSTRIAL TRAINING:** duration 24 days

Lectures 240

**Books recommended for Practical:**

1. APHA (American Public Health Association) Handbook,1998
2. Soil, Plant and Water Analysis - P. C. Jaiswal
3. Chemical and Biological Analysis of Water - Dr. R. K. Trivedy and P. K. Goel.
4. Practical Biochemistry - J. Jayraman

**Practical Examination**

- A) The practical examination will be conducted on three (3) consecutive days for not less than 6 hours on each day of the practical examination.
- B) Each candidate must produce a certificate from the Co-ordinator and Head of the Department in his/her college stating that he/she has completed in a satisfactory manner the practical course on the guidelines laid down from time to time by Academic Council on the recommendation of Board of studies and has been recorded his/her observations in the laboratory journal and written a report on each exercise performed. Every journal is to be checked and signed periodically by a member teaching staff and certified by the Co-ordinator and Head of the Department at the end of the year. Candidates are to produce their journal at the time of practical examination. Candidates have to visit industries as per the syllabi and also should satisfactorily the Training programme at recommended Industry partner and should submit their respective reports at the time of examination. The report should be duly certified by the Co-ordinator and Head of the Department.

C) **NATURE OF QUESTION PAPER (THEORY):** Mentioned separately.

**D) NATURE OF QUESTION PAPER AND DISTRIBUTION OF MARKS FOR PRACTICAL EXAMINATION:**

**Industrial training report: 50 marks**

**Practical examination: 100 marks for each practical course**

Q.1 Major Experiment 25 Marks

Q.2 Major Experiment 25 Marks

Q. 3 Minor Experiment 10 Marks

Q. 4 Minor Experiment 10 Marks

Q.5 Spotting 20 Marks

Q.6 Journal 10 Marks

**List of the minimum equipments and related requirements for Diploma course:**

1. Centrifuge (High Speed) : One
2. Hot plate : One
3. Hot air oven : One
4. Incubator : One
5. Spectrophotometer : One
6. Compound Microscope : One for each student
7. Separate room for fine instruments of size 10'x15' feet dimension
8. A separate culture room of at least 10' x 10' feet dimension
9. Laminar air flow cabinet : one
10. Distillation assembly : One (Glass)
11. Reflux assembly : Four
12. Serological Water bath : One
13. Colony counter : One
14. Refrigerator : One

**NOTE :**

- i) The details of field visits, Industrial training be given wherever necessary.
- ii) General/Specific instructions for Laboratory safety should be given wherever necessary)

**OTHER FEATURES:**

- 1. INTAKE CAPACITY / NUMBER OF STUDENTS:-**  
Maximum 50
- 2. TEACHERS QUALIFICATIONS:-**  
Masters degree in Environmental Science/Environmental biotechnology/  
Microbiology/Zoology/Botany with NET/SET/Ph.D qualification.
- 3. THE BOARD OF STUDIES SHOULD CLEARLY MENTION THE REQUIRED BOOKS, JOURNALS AND SPECIFIC EQUIPMENTS NECESSARY FOR THE COURSE.**
  - (A) LIBRARY: Reference and Text Books, Journals and Periodicals, etc.-  
List attached
  - (B) SPECIFIC EQUIPMENTS: Necessary to run the Course - OHP,  
Computer, L.C.D., Projector, etc.
  - (C) LABORATORY SAFETY EQUIPMENTS :
    - 1) Fire extinguisher
    - 2) First aid kit
    - 3) Fumigation chamber
    - 4) Stabilized power supply
    - 5) Insulated wiring for electric supply.
    - 6) Good valves, distribution pipes & regulators for gas supply.
    - 7) Operational manuals for instruments.
    - 8) Emergency exits.