DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Syllabus of

B.Sc. III YEAR

ENVIRONMENTAL SCIENCE

Semester-V & VI

[Effective from 2011-12 & onwards]

B.Sc. III year, Semester V

EVS 351 (Paper – XVII): Water Pollution

Unit I: **Water Pollution:** Introduction
- Meaning of the term- Potability, sewage, affluent effluent, sample, contamination, eutrophication, pollution, pollutants.
- Sources of water pollution
- Types of water pollution – Freshwater pollution

Unit II: Water pollution
- Ground water pollution
- Surface water pollution –River pollution, Pond and lake pollution;
- Major water pollutants,
- Effects of selected pollutions on fresh water flora & fauna

Unit III: Marine Pollution
- Introduction
- Pollution of Marine Environment
- Oil pollution
- Flora & fauna of bio-indicators to oil spill.
- Oil spill – clean up options.

Unit IV: Quality of water
- Meaning of pure water
- Impurities in water
- Analysis of water :
- Physical paremetres.
- Chemical paremetres.
- Bacteriological paremetres.
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- Water borne diseases

Unit V: - Water pollution control measures .
- Need of Water pollution legislation:
- The Water (Prevention and control of Pollution Act, 1974)
- Stockholm water prize

Recommended books:

1. Environmental science: S. C. Santra, (New Central Book agency (p) Ltd.)
2. A. Text book of Environmental Studies: D. K. Asthana (S. Chand & Camp Ltd.)
3. A. Text book of Env Science: R. N. Trivedy (Anmol Pub.pvt ltd.)
4. Water supply & sanitary engineering: S. C. Rangwala (Charotar Pub. House Anand)
5. Environment studies: Dr. K. Mukkanti (S. Chand & camp. Ltd.)

EVS 352 (Paper – XVIII): Treatment Technology

Unit I: Introduction
- Wastewater: Definition, Types and sources.
- Need of wastewater treatment
- Collection of waste water : Domestic sewerage system

Unit II: Sewage Treatment Methods: Principle, working mechanism, Advantages and disadvantages

i) Preliminary Treatment - Grit chamber,
-Floatation,
-skimming tank,
-screening

ii) Primary treatment:- Sedimentation (clarifier)
, - Coagulation (chemical precipitation process)

Unit III: Secondary Treatment or Biological treatment:

Aerobic -Trickling filters
-Activated sludge
- Oxidation ponds and lagoons

Anaerobic: -Septic tanks
- Sludge digestion and Disposal

Unit IV: Tertiary Treatment or Chlorination:

Aim, Need for Chlorination,
Dose of Chlorine,
Ozonisation

Unit V: Case study: Sugar Industry ETP,
Distillery ETP,
Tannery ETP

Unit VI: Water Purification Methods:
- Collection of raw water
- Sedimentation
- Coagulation
- Filtration
- Disinfection

Case Study: Water purification treatment plant at Pharola Aurangabad.

Reference Books:

1) Water and waste water Engineering- R.C. Rangwala
2) Water and waste water Engineering (Vol.II)- Fair/ Geyer/Okun.
3) A text book of sanitary Engineering – Vinayak Gharpure
4) Waste water Engineering –Metcalf and Eddy , Inc. Pub.
5) Chemical and Biological Methods for water pollution – R. K. Trivedy and P. K. Goel, Enviro Pub., Post Box 60, Karad. 2001.
6) Methodology of water Analysis- M. S. Kodarkar, IAAB Publication, Hyderabad. 2006
7) Water and wastewater analysis- NEERI Pub., 2008, Nagpur.

EVS 353 (Paper –XIX) : Lab Course – IX

1. Study of sampling techniques.
2. Study of preservation of water samples.
3. Determination of BOD of water sample.
4. Determination of COD of water sample.
5. Determination of Suspended solids of water sample.
6. Determination of dissolved solids of water sample.
7. Determination of total solids of water samples.
8. Determination of Oil & Grease in polluted water.
9. Determination of Free CO_2 in water sample.
10. Estimation of abundance Phytoplankton's from water samples.
11. Quantitative techniques in aquatic microbiology – SPC
12. The presumptive, confirmatory and completed tests for determination of sewage contamination.
13. Determination of Water Quality Index (WQI).

EVS 354 (Paper –XX) : Lab Course – X

1. Estimation of sulfate from water sample
2. Estimation of phosphates from water samples
3. Estimation of nitrates from water sample
4. Estimation of nitrites from water samples
5. Estimation of ammonia in water samples
6. Determination of conductivity of water sample
7. Jar test demonstration
8. Determination of chlorine by chloroscope
9. Determination of redox potential of water samples
10. Determination Hydrogen Sulphide in sewage sample.
11. Determination of dissolved oxygen from polluted water sample by using azide modification.
12. Determination of Turbidity from given water sample.

B.Sc. III year, Semester VI

EVS 361 (Paper – XXI): Toxicology & Environmental Issues

Unit 1: Introduction

Toxicology: Definition, Classification of toxic substance i.e. Toxic gases, organic Poison, Inorganic poison, Toxins**.**

Unit 1I: a) Factors affecting Toxicity:

- Chemical factors: Polarity, Molecular weight, Nature of Chemical, Type.
- Biological factors: Sex, Age, Body weight, Heredity and Genetic characters.

b) Dose-response relationship.

Unit 1II: Occurrence, Pollution source, uses, effect and remedial measures of**:**

a) Gases- CO, CO_2, H_2S, SO_2.
b) Heavy metals- As, Pb, Hg, Cu,

Unit 1V: Occurrence, Pollution source, uses, effect and remedial measures of**:**

a) Hydrocarbons
b) Alcohol- Ethyl alcohol
c) Pesticides-

Unit V: Carcinogenesis, Chemistry of Carcinogenic compound carcinogens, mutagens and teratogens, cancer causing agent Neoplasm. Drugs, Tobacco, Narcotic

Unit VI: Environmental Issues:

- Sustainable development,
-Biodiversity conservation,
- Lake restoration,
- Use of solar and wind energy,
- Environmental Impact Assessment of Major developmental activities,
- Scheme of labeling of environmental friendly products (Eco-marks)

Reference Books

i) Environmental toxicology by,. M. Satake, Y. MIDO, M. S. Sethi
ii) Environmental Chemistry: H. Kaur
iii) Environmental Chemistry: A. K. De
iv) Medical Jurisprudence and toxicology: Parekh
v) Environmental science – Botkin Keller

EVS 362 (Paper – XXII): Industrial safety & Hazardous Waste

Unit I: Introduction

Introduction to safety and safety management

Need for integration of safety, health and environment (S, H &E)

Conman safety tips – personal protection, lockout, accident prevention signs, occupational noise, fire safety, ladder safety.

Unit II: Industrial safety

Introduction

Hazard checklist- house keeping (Meaning & methods) machine hazards, fire hazards, protective equipments, electrical equipments, tools.

General safety Rules.

Unit III: Safety Management

- Safety management, - Principles of safety management
- Fire preservation, - Accident prevention (Principle, Basic terms)
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Unit IV: Hazardous Waste

Definition

Sources of hazardous waste

Classification of hazardous waste – biomedical waste, radioactive waste, chemical waste, household hazardous waste

Characteristics of hazardous waste ignitability (flammable)

Reactivity, Corrosivity, Toxicity

Unit V: Effects of hazardous waste, Bhopal Gas Tragedy

Unit VI: Disposal of hazardous waste

Recycling , Neutralization., Incineration, Pyrolysis,

Hazardous waste landfill

Reference Books:

1) ' Industrial safety management'
   Hazard Identification and Risk control'
   Deshmukh L. M., Tata McGraw – Hill publishing company Ltd. New Delhi.
2) ' Industrial safety, health and environment management system'
   Jain R. K., Rao Sunil, Khanna Publishers, Delhi.
3) 'Eco-Informatics' – wealth from waste, Vol. III
   Agarwal S. K., A.P. H. Publishing corporation, New Delhi.
4) 'Fundamentals of Environmental science' Dhaliwal G.S., Sangha G.S., Ralhan P.K., Kalyani Publishers, New Delhi.
5) 'Environmental Science'
   Santra S.C.,New central Book Agency (P) Ltd. Kolkata.
6) Fundamentals of industrial safety and health
   Dr. K. U. Mistry, Siddhartha Prakashan, Janak society opp. Navrang High school, AHMEDABAD -38001.

EVS 363 (Paper –XXIII) : Lab Course – XI

1) Estimation of Zn from provided contaminated water sample
2) Determination of iron content from contaminated water.
3) Estimation of Pb from provided contaminated water
4) Estimation Cu from provided contaminated sample
5) Estimation Mn from provided contaminated water sample
6) Effect of pesticides on seed germination
7) Effect of Heavy metals of seed germination
8) To study the effects of gaseous pollutant SO_2 on plant (Leaves and flowers).
9) To study the effects of gaseous pollutant H_2Son plant (Leaves and flowers).
10) To study the bioaccumulation of heavy metals and pesticides in living organisms.
11) Qualitative detection of pesticides from waste water.
12) Estimation of Hg from provided contaminated water

EVS 364 (Paper –XXIV) : Lab Course – XII

Project work, Industrial visit report and Seminars.

i) **Project report**: One project has to be completed during the third year as a part of practical paper of sixth semesters Lab course XII. The project work is to be allotted during the fifth semester beginning along with the allotment of guides. As a part of project work, a field observations or the experimental work with specific aims and objectives can be given to the candidates. The data collection and preparation of review article on any specific topic by referring recent scientific literature can be a part of project work. The project report is to be submitted in triplicate before the semester end theory and practical examination of sixth semester. There will be 30 marks to the project report out of total 50 marks.

ii) **Industrial visit report**: At least one industrial visit is to be arrange during each semester. The industrial visit report is to be submitted along with project report.

iii) **Study tour report**: The study tour is to be arrange for understanding environment in total. The participation in study tour and industrial visit is compulsory. The study report is to be submitted.

iv) **Seminar presentation**.

List of chemicals, Instruments, equipments etc.

List of chemical Required for B.Sc. Ist Year

Sr. No.	Name of the chemical
1.	Liquid soap
2.	Detergents
3.	Sodium hydroxide (NaOH)
4.	$K_2C_2O_7$
5.	Trisodium phosphate (Na_3PO_4)
6.	Conc. Hydrochloric acid
7.	Conc. HNO_3
8.	$FeSO_4$
9.	H_2SO_4
10	Sodium thiosulphate ($Na_2S_2O_35H_2O$)
11	Burnol
12	Acetic Acid
13	NH_3 Solution (Ammonia solution)
14	Glycerin
15	Na_2CO_3
16	Boric acid
17	$NaHCO_3$
18.	Buffer tablets of pH 4, 7.0, 10
19.	Kcl
20..	Class work Material for Zoo and Phytoplanktons
21.	Sodium carbonate (Na_2CO_3)
22.	Phenolphthalein
23.	Methyl orange
24.	DPX
25.	Crystal Violet
26.	Safaranine
27.	Iodine solution / Iodine Crystals
28.	Kovan reagent
29.	Dettol
30	Alcohol (Absolute Alcohol)

List of Instruments Required for B.Sc. Ist Year

Sr. No.	Name of the instrument
1.	First –Aid Kit
2.	Microscope
3.	Hot Plate
4.	Colorimeter
5.	pH meter
6.	Conductivity meter
7.	Sacchi disk
8.	Incubator
9.	Inoculation Chamber
10	Oven
11	Digital balance
12	Physical balance or one pan balance
13	Rain gauge
14	Thermometers
15.	Chloroscope
16	Desiccator
17	Soil testing kit
18.	Zircondroff's apparatus
19.	Gas (LPG gas with burner)
20.	Stop watch
21.	UV-Visible spectrophotometer
22.	Turbidity meter
23.	BOD incubator
24.	Colorimeter

List of Equipments Required for B.Sc. IInd Year

Sr. No.	Name of the equipment
1.	pH meter
2.	Conductivity meter
3.	Turbidity meter
4.	Sacchi disk
5.	Rain Gauge
6.	Incubator or BOD incubator
7.	Inoculation chamber
8.	Micro–Scope
9.	Autoclave
10	Desiccator
11	Oven
12	Colony Counter
13	Hot Plate
14	Gas (LPG gas with burner)
15.	Spirit lamp
16	Tripod stand
17	Stop watch
18.	Dust fall measurement jar
19.	Tilak air sampler
20.	High volume air sampler
21.	Durham's sampler
22.	Co-detector
23.	Psychrometer
24.	High Volume Air Sampler
25	Zircondroff's Apprafus
26.	Sound level meter
27.	Flame Photometer
28	Balance (One pan or two pan)
29.	Digital balance
30.	Anemometer
31.	Laminar air flow

List of chemicals required for B.Sc. IInd Year

Sr. No.	Name of the Chemicals	Sr. No.	Name of the Chemicals
1.	$Na_2 SO_4$	31.	Dipotasium hydrogen phosphate
2.	Iron Sulphide	32.	Bromothymol blue
3.	Hcl (Conc.)	33.	α - Napthol
4.	H_2SO_4 (Conc.)	34.	KOH
5.	$CuSO_4$	35.	Crystal Voilet
6.	Sodium carbonate (Na_2CO_3)	36.	Gram's Iodine
7.	Phenolphthalein	37.	Ethanol (Ethyl Alcohol)
8.	Methyl orange	38.	Potassium iodine
9.	Dextrose	39.	Acetone
10.	Glycerin	40.	Nigrosin
11.	EDTA sodium salt	41.	Phenol
12.	Sodium hydroxide	42.	Sodium hydroxide
13.	Muroxide	43.	Potassium Iodide (KI)
14.	Sodium Chloride NaCl	44.	Starch
15.	Ammonium Chloride NH_4Cl	45.	$MnSO_4$ $4H_2O$
16.	NH_4OH	46.	Potassium dichromate ($K_2Cr_2O_7$)
17.	$Mg SO_4$	47.	Ferrous Ammonium Sulphate
18.	Peptone	48.	K_2CrO_4
19.	Agar agar	49.	Ferroin indicator
	Crystal Violet	50.	Mercuric sulphate
20.	Iodine Solution	51.	Silver sulphate
21.	Alcohol	52.	Eriochrome Black T
22.	Saffranin	53.	Na_2S
23.	Lactose	54.	Acetic acid
24.	Methyl Red	55.	Potassium iodide
25.	Sodium taurocholate	56.	Petroleum ether
26.	Glucose	57.	$Ag NO_3$
27.	$Na(NH_4) PO_4$		
28.	K_2HPO_4		
29.	Sodium Citrate		
30.	Ammonium- dihydrogen phosphate		

List of Instruments Required for B.Sc. III[rd] Year

Sr. No.	Name of the instruments
1.	Digital balance
2.	Balance (one or two pan)
3.	COD Digester
4.	Jar Test Apparatus
5.	Nephlometer
6.	Spectrophotometer
7.	BOD incubator
8.	Hot plate
9.	Desiccator
10	Gas (LPG with burner)

List of chemicals required for B.Sc. III[rd] Year

Sr. No.	Name of the Chemicals	Sr. No.	Name of the Chemicals
1.	EDTA (Sodium salt)	23.	NaCl
2.	Zinc Sulphate ($ZnSO_4$)	24.	Na_2S
3.	Hcl	25.	NH_4Cl
4.	Hexa-amine	26.	Eriochrome Black –T
5.	Xylenol orange	27.	Ethyl Alcohol
6.	Lead acetate	28.	Petroleum Ether
7.	Aluminium Sulphate	29.	Acetic Acid
8.	Pesticides	30.	Potassium iodide
9.	Sodium Citrate	31.	Sodium thiosulphate
10	Dihydrate	32.	Starch
11	Bengene Sulphonate	33.	Manganous Sulphate
12	$K_2Cr_2O_7$	34.	Calcium Chloride
13	Fe ($NH_4)_2$ (SO_4)	35.	Ammonium molybdate
14	Ferroin	36.	Stannous chloride
15.	Mercuric Sulphate	37.	K_2HPO_4
16	Silver sulphate	38.	Glycerol
17	Na_2 CO_3	39.	Barium chloride
18.	Methyl Orange	40.	Na_2SO_4
19.	Phenolphthalein	41.	Zinc Sulphate
20.	NaOH	42.	KNO_3
21.	Sulphuric acid		
22.	AgNo3		

List of common Glassware's & other requirements for B.Sc.Ist, IInd and IIIrd Year

Sr. No.	**Glassware's**	Sr. No.	**Glassware's**
1.	Reagent Bottles	21.	Brass Box
2.	Watch glass	22.	Test tube -10ml, 20ml, 5ml.
3.	Niddle	23.	Jar 2.5 lit.
4.	Forceps	24.	Separating funnels
5.	China dish	25.	Tiles
6.	Crucibles	26.	Bel Jar
7.	Aquarium	27.	Plant Pot
8.	Slide box	28.	Filter paper
9.	Cover Slip	29.	pH-paper
10.	Burette	30.	Whatman filter paper No. 41, 42
11.	Pipette	31.	Cotton
12.	Conical flask	32.	Rubber band
13.	Beakers	33.	Inoculating needles
14.	Burette stand	34.	Nails
15.	Petri Plate	35.	Threads
16.	Funnel	36.	Chromatography paper
17.	Measuring Cylinder - 1000ml ,100ml, 50ml,10ml.	37.	TLC Chamber
18.	Standard dilution flask - 100ml,250ml, 50ml.	38.	Sprayer
19.	Petri dish	39.	Butter Paper
20.	BOD Bottles		

List of common chemicals required.

Ammonium Molybdate AR	Calcium Hydroxide
Ammonium Sulphate	Dextrose anhydrous
Ammonium Ferrous sulphate	D-Glucose anhydrous
Ammonium Oxalate	Diphenylanine
Ammonium Chloride	Diphenylamine (extra pure)
Ammouium Carbonate	Diphehyl carbazide
Ammouium Purported	EDTA LR (disodium salt)
Ammouium Buffer	Eriochrome Black – T
Agar-Agar Powder	Eosin (M.S.)
Alizarin reds (Sodium alizarin sulphonate)	Ethanal
Ammonia Solution	Ferric chloride
Arsenic trioxide	Ferrous sulphate LR.
Acetic Acid (glacial)	Ferroin solution GR.
Ammonium Hydroxide (conc.)	Ferric Nitrate
Berium Chloride	Fushsin basic (M.S.)
Bromophenol Blue	Ferrous chloride
Bleaching powder	Gram's Iodine
Boric Acid (powder)	Gram's safranine
Beef Extract (Powder)	Granis Crystal violet
Benedict's Reagent	Glycerol
Buffer Tablets (pH 4.0)	Carmine
Bronophenol Blue (A.R.)	Hydroxyl Ammonium chloride
Calcium Chloride (Fused)	Hexanol
Calcium sulphate	Hydrochloric Acid
Calcium carbonate	Iodine crystals.
Copper Sulphate	Iron
Copper Fillings	Kovac's Indole Reagent
Copper (Metal)	Lactose monouydrate
Crystal Violet	Lead Acetate L.R.
Cadmium sulphate	Manganous Chloride A.P.
Cadmium chloride	Magnesicn Chloride (hex hydrate)
Cupric sulphate	Magnesium (extra pure)
Manganese dioxide A.R.	Phenol
Manganous sulphate (Monohydrate LR.)	Sodium hydroxide
Magnesium Sulphate (Hepta hydrate)	Sodium Nitrate
Metuyl orange Extra pure	Sodum phosphate
Murexide Indicator	Sodium chloride
Murcuric sulphate	Sodium hydrogen
Mercuric Iodide red.	Sodium suphate
Methyl orange indicator	Sodium sulphide
73.Metuylene Blue GR.	Sodium Arsenate
Mutvutiv vhlotifr	Sodium Acetate
Macconkey's Broth	Sodium fluoride

Nigrosine (water Soluble)	Starch soluble (Potato)
Neutral Red.	Sulphanilanide
Nessler;s Reagent	Sodium Nitropurside
N- Ci- (Nephl) doane dihydrochloride R.	Misodium tetra borate
N- Propyl Alcohol	Di sodium hydrogen orthophosphate.
Potassium chromate	Sulphuric Acid
Potassium chloride	Tri –Sodium citrate
Potassium carbonate anhydrous	Sodium met silicate
Potassium dichromate.	Di – Sodium phosphate
Potassium dehydrogen orthophosphate	Sodium oxalate
Di-potassium hydrogen orthophosphate	Sodium suphite
Potassium hydrogen carbonate.	Sodium metamisulphite
Potassium dichromate.	Safranine – acetic acid.
Potassium hydroxide pellets (KOH)	Silver sulphate
Potassium Iodide	Sodium oxalate
Potassium Nitrate	Solochrome Black –T
Potassium permanganate	Sodium tetrachloride pullulate
Poptone	Stannous chloride
Phenolphthalein	Vaseline
Phenanthroline	Xylenol orange (GR.)
Parafin liquid	Zinc sulphate LR.
Pthalic anhydride	.Zink chloride
Petroleum Ether	
Phosphoric Acid.	
Sodium carbonate	

List of common Instruments,

Sr. No.	Instruments Name.
1.	Autoclave
2.	Colorimeter
3.	Carbon – monoxide (CO) detector
4.	Flame photometer
5.	Refrigerator
6.	High volume air sampler
7.	Hot air oven
8.	Hot Plate
9.	Microscope
10	Nephlometer
11	Psychrometer
12	Precision balance
13	Sound level meter
14	Microscope (Zoom Camera)
15	Over head projector
16	Spectrophotometer
17	Water quality analyzer