VEER NARMAD SOUTH GUJARAT UNIVERSITY
M.Sc. SEMESTER-IV
ENVIRONMENTAL CHEMISTRY

SYLLABUS TO BE EFFECTIVE FROM JUNE 2019
Paper-I-WATER AND SOIL ANALYSIS AND POLLUTION REMEDIES

Max. Marks: 70 Total Periods: 45

Unit-1 ANALYSIS OF WATER POLLUTANTS (12 Periods)

- **Sampling methods and preservation,**
  DO, BOD and COD- Signification, Analytical Methods, Interferences and their elimination, Modifications
  Color, pH, Test, Odour, Hardness, TDS, Alkalinity, Chloride, Fluoride, Sulphate, Ammonical Nitrogen, Nitrite, Nitrate, Phosphate, Iron, Fluoride Heavy Metals, Silica

Unit-2 WATER TREATMENT (11 Periods)

(A) Water purification; Natural Water Purification Processes- Treatment for Potable Water, Preliminary treatment, Primary treatment: Sedimentation, Flocculation
Secondary treatment: Trickling filters, Activated Sludge,Tertiary treatment: Chlorination, Wet Oxidation, adsorption, Reverse Osmosis, Electro dialysis Ion exchange and water disinfection.

(B) Sewage treatment- Removal of Solids , metals (Ca, Fe, Mn), Removals of dissolved organic and inorganic compounds, Sludge dewatering and disposal.

(C) Water management-Water Reuse and Recycling, Rainwater harvesting

Unit-3 INDUSTRIAL WATER POLLUTION PROBLEMS AND REMEDIES (11 Periods)

- **Industrial water pollution-** Site of pollution and remedies with flowcharts in
  - Pharmaceutical Industry
  - Fertilizers Industry
  - Pulp and Paper Industry
  - Sugar Industry
  - Distillery Industry
  - Textile Industry.

Unit-4 SOIL ANALYSIS (11 Periods)

- pH
- Lime requirement of soil
- Nitrogen analysis
- Phosphorous analysis
- Exchangeable Cation Analysis
- Micro nutrient analysis
- Trace element in soil analysis
- Analysis of pesticides- Standard and polarographic analysis

Recommended books:

1. Environmental Chemistry by Manhanan.
2. Environmental Pollution Monitoring and control by S. M. Khopkar
3. Introduction to Environmental Analysis by Roger N. Reere. John Wiley & Sons.
4. Industrial Safety and Pollution control handbook. Published by National Safety Council and Associate (Data) Publishers Pvt. Ltd.
5. Environmental Chemistry, Goel Publishing house meerut, by B. K. Sharma and H. Kaur
6. APHA Standard Methods 21st Edition

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PAPER- II (AIR ANALYSIS AND POLLUTION CONTROL METHODS)

Max. Marks: 70 Total Periods: 45

Unit-1 Analysis of Air pollutants (12 Periods)

Sampling of Particulate matter and Gaseous air pollutants-
Sedimentation, HVS, Tape Sampler Impingement, Electrostatic precipitation, Adsorption in Liquid and solids, Thermal precipitation, Stack sampling system (Train), Preservation of samples.
Analysis of Oxides of Sulphur, Nitrogen Oxygen and Carbon, H_2S, Mercaptons, Hydrocarbons and Organics, Elemental Analyser Analysis of Particulate Matter, Direct Spectrophotometric Analysis of Gaseous Air Pollutants
Atmospheric Monitoring

Unit-2 AIR POLLUTION CONTROL METHODS AND EQUIPMENTS (11 Periods)

Air pollution Control Methods and Equipments: Source, Collection methods, cleaning of gaseous effluent, particulate emission, absorption, adsorption, Odour control units, Limestone injection and fluidized bed combustion, Desulfurization;, Gravity settling chamber, Centrifugal collectors- cyclone collector and dynamic precipitators; Electrostatic precipitators; wet and dry Scrubbers, filters, Fabric filters. Combustion, Absorption and Adsorption Devices, Catalytic converter and control of vehicular emission

Unit-3 INDUSTRIAL AIR POLLUTION PROBLEMS AND REMEDIES (11 Periods)

Removal, Recovery and Destruction of SO_2, NO_2, H_2S, Organic Vapours and Particulates matters from production houses. Microbial cleaning.
Petroleum refinery, Cement industries, Fertilizers Industry, Thermal power plants Iron and Steel industries, Chemical Process industries-Mineral Acid manufacturing and Chloralkali Plants, Microbial cleaning of gases (Bio-filtration and bio-scrubbing)

Unit-4 BIOREMEDIATION (11 Periods)

- Microbial systems of bioremediation; factors influencing bioremediation (Environmental, Physical and chemical actors)
- Application of genetically engineered microorganisms for waste management
- Microbial aerobic and anaerobic biotransformations
- Bioremediation systems and processes (Solid, Liquid and Slurry phase)
- Microbial detoxification of specialty chemicals (Insecticides, Herbicides, Fungicides, Polychlorinated biphenyls, Heavy metals

Reference Books:

1. Basic Concept of environmental Chemistry by Des. W. Connell.
2. Chemistry for environmental Engineering 4th Ed., By sawyer, McCarty and Parkin.
3. Environmental Pollution Monitoring and control by S. M. Khopkar.
4. C.S. Rao, Environmental Pollution Control Engineering. Wiley Eastern Ltd. 1991.
5. John H. Seinfeld Air pollution:Physical and Chemical Fundamental McGraw Hill1998.
6. M.N. Rao and H.V. Rao Air Pollution, Tata Mcgraw Hill Book Co. 1989.
7. Hand book of Air Pollution , Prevention and control: Nicholas P. Cheremisinoff Elesvier 2nd edition.
8. C.S. Rao, Environmental Pollution Control Engineering. Wiley Eastern Ltd. 1991.
9. John H. Seinfeld Air pollution:Physical and Chemical Fundamental McGraw Hill1998.
10. M.N. Rao and H.V. Rao Air Pollution, Tata Mcgraw Hill Book Co. 1989.
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PAPER- (III) GREEN TECHNOLOGY

Max. Marks: 70 Total Periods: 45

Unit-1 Green technology (12 Periods)

Overview of green chemistry, principles of sustainable and green chemistry. Basic principles of green technology, concepts of atom economy and carbon trading, tools of green technology. Waste minimization and climate change, Zero waste technology, concept of environmentally balanced industrial complexing and industrial ecology

Unit-2 Green synthetic methods and designs (11 Periods)

Catalytic methods in green synthesis, safer chemicals – different basic approaches; selection of auxiliary substances (solvents, separation agents), green solvents, solventless processes, immobilized solvents and ionic liquids; energy requirements-use of microwaves, ultrasonic energy; selection of starting materials; use of blocking/protecting groups, catalytic reagents; designing of biodegradable products.

Unit-3 Green Nanotechnology (11 Periods)

Introduction to Nanomaterials and green nanotechnology, Fullerene, carbon nanotubes, Nanoparticles; Green nanoparticle production and characterization; Biocompatibility; Nanomedical applications of green nanotechnologies; use of nanotechnologies and materials impact on biodiversity, resource conservation, ecosystems and human.

Unit-4 Green Technology Applications (11 Periods)

Biocatalysis, green chemistry in industries, fuel cell and electric vehicles, solar energy and hydrogen production, energy from alternate sources; Solar photovoltaic technology, Biofuel production (bio-ethanol and biodiesel), Biomass, prevention/minimization of hazardous/ toxic products. Agricultural related practices and food processing, Production of biodegradable materials, concept of green building, Pollution free engineering processes.

Recommended Books:

1. Lynn Goldman, Christine Coussens, Implications of nanotechnology for environmental health research, National Academic Press, Washington, 2007
2. Matlack, A. S. Introduction to Green Chemistry. Marcel Dekker: New York,2001
3. Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice. Oxford Univ. Press:Oxford,
4. Caye Drapcho, Nhuan Phú Nghiêm, Terry Walker (2008). Biofuels Engineering Process Technology. [McGraw-Hill].

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PAPER- (IV) AUDIT, LAWS AND CASE STUDIES

Max. Marks: 70 Total Periods: 45

UNIT-1 ENVIRONMENTAL IMPACT ASSESSMENT: (12 Periods)

Definition and terminologies, Basic Description of EIA processes. Biosolid management practices and regularity requirements. Environmental facility and assessment and Audit.

UNIT-2 ENVIRONMENTAL PROTECTION LEGISLATIONS (11 Periods)

Pollution control boards, EPA-US, The Environment (Protection) Acts enacted by CPCB-India for water, air, noise and waste management. GPCB, Legislation and legal aspects: Water (Prevention and control of Pollution) Act 1974, Air (Prevention and control of Pollution) Act 1981,Wild Life protection act, 1972, The India Forest Act, 1927, The Environment protection Act, 1986,

UNIT-3 HAZARDOUS WASTE MANAGEMENT : (11 Periods)

Description of the Environmental settling, Prediction and Assessment of impact on air, water, Noise and Biological environment. Laws and regulations, E- waste management and Handling Rule 2011, Plastic Manufacture, Sale, Usage sale Rule 2011, 2016 and issues involved in enforcement of environmental legislation.

UNIT-4 ENVIRONMENTAL MOVEMENTS AND CASE STUDIES (11 Periods)

Chernobyl disaster, The Exxon Valdez Oil Spill, Bhopal gas Tragedy, Movements related to Environment Sacred groves, Bishnoi tradition, Chipko movement, Tehridam, Sardar Sarovar, Narmada dam, Almatti dam, Silent Valley. Supreme Court Cases – Ratlam Municipality, Ganga Action Plan, Taj Trapezium, Delhi CNG, Tamil Nadu Tanneries, Doon Valley, Span motels private limited case, Oleum gas case.

Reference:

1. Environment impact assessment: David P Lawrence, Wiley inter science 2003.
2. Environment impact assessment handbook: Barbara Carroll, Trevor Turpin, Thomas Telford 2003.
3. Case Studies in the Environment Editor-in-Chief: Wil Burns, Vol 3, 2019,ISSN: 2473-9510

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ENVIRONMENTAL CHEMISTRY PRACTICAL

SYLLABUS TO BE EFFECTIVE FROM JUNE-2019

1	Major Exercise	4- Credit
2	Viva-Voce	
3	Minor Exercise	4- Credit
4	Minor Exercise	

Major Experiments

1. Analysis of dolomite ore by gravimetry.
2. Determination of the amount of Fe in Cement by optical method.
3. Analysis of Portland cement for the major constitute.
4. Separation of Zn^{+2} & Mg^{+2} ion by an anion exchange resin.
5. Potentiometric determination of Chloride, Bromide and Iodide in a mixture.
6. Analysis of Pyrolusite ore for the major constitute.
7. Separation and determination of total pigment in a paint sample.
8. Determination of volatile thinner in a paints sample.
9. Determination of Cr and Mn in a steel sample photospectrometry.
10. Determination of the total salt amount content in given Water using Ion Exchange Chromatography (IEC). (Dowex cation).

Minor Experiments

11. Determination of the thiosulphate in a given solution.
12. Analysis of dye intermediate containing $–NH_2$ by Potentiometric titration.
13. Determination of Nitrite spectrophotometrically.
14. Biuret in the sample of urea
15. Determination of fluoride in a given solution / tooth paste by Zirconyl-Alizarin red method colorimetrically
16. Analysis of organic materials: Glycerol, Glycine, phenol.
17. Determination of the % of Ca & Mg both combined volumetrically.
18. Estimation of Fe by colorimetry.
19. Determination of the concentration of Cr^{+3} and Co^{+2} in a given mixture using spectrophotometer.
20. Titrimetric determination of L-ascorbic acid. (Vitamin C)
21. Determination of the individual concentration of $Cu^{+2}$and Ca^{+2} in a mixture using by EDTA solution and complexometric titration.
22. Determination of Ka1 and Ka2 of phosphoric acid.
23. Determination of Ca present in $CaCO_3$ with Vitamin D_3 tablet using EDTA by volumetrically.
24. Paper Chromatography.

Note:

- Practical examination will be for **2 days in each semester.**
- **6** hours duration on each day.

Recommended books:

1. Quantitative Inorganic Analysis including Elementary Instrumnetal analysis, By A. I. Vogel, 3ed, ELBS, 1964.
2. Vogel's Quantitative Chemical Analysis; J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, B. Sivasankar; Pearson Publication.
3. Analytical Chemistry; Gary D. Christian; Willey India Pvt. Ltd.
4. Evironmental Pollution, A.K. De
5. Evironmental Pollution, B.K. Sharma & H.Kaur
6. Quantitative Analysis by R.A. Day and A. L. Underwood, (Sixth Edition)
7. Standard methods of chemical analysis, Sixth Edition, F.J. Welcher.
8. Standard Methods of Chemical Analysis: Vol. I & II (6th edition), D. Van Nostrand Co. Inc. (London).
9. Official Methods of Analysis: Published by Association of Official Analytical Chemists, Washington.
10. Advance practical physical chemistry by J. B. Yadav
11. Advanced University Practical chemistry by P.C. Kamboj (Part-1)
12. Advance Practical Chemistry by R. Mukhopadhyay and P. Chatterjee
13. Official Methods of Analysis: Published by Association of Official Analytical Chemists, Washington.
14. APHA Standard methods 21st Edition.