Re-Accredited 'B++' 2.86 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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–: પરિપત્ર :–

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન અનુસ્નાતક અભ્યાસક્રમ ચલાવતી તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા વિભાગીય વડાશ્રીને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર M.Sc.Sem. 4 ના Pharmaceutical Chemistry, Organic Chemistry, Physical Chemistry, Enviornmental Chemistry અને Analytical Chemistry ના અભ્યાસક્રમ સંદર્ભે રસાયણશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તા.૦૪/૧૨/૨૦૨૩ની સભાના ઠરાવ ક્રમાંક :૦૫ અન્વયે નીચે મુજબ કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૬/૧૨/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ ૪૬ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

રસાયણશાસ્ત્ર વિષયનીઅભ્યાસ સમિતિની તા.૦૪/૧૨/૨૦૨૩ ની સભાનાં ઠરાવ ક્રમાંકઃ૦૫

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર M.Sc.Chemistry Sem.-4 નો Pharmaceutical Chemistry, Organic Chemistry, Physical Chemistry, Enviornmental Chemistry અને Analytical Chemistry નો અભ્યાસક્રમ સર્વાનુમતે મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૬/૧૨/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ ૪૬

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪થી અમલમાં આવનાર M.Sc. Chemistry Sem.-4 ના Pharmaceutical Chemistry, Organic Chemistry, Physical Chemistry, Enviornmental Chemistry અને Analytical Chemistry ના અભ્યાસક્રમ સંદર્ભે રસાયણશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તા.૦૪/૧૨/૨૦૨૩ ની સભાના ઠરાવ ક્રમાંક :૦૫ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંક : એસ./સાયન્સ/પરિપત્ર/૩૦૫૧૯/૨૦૨૩
તા.૦૭–૧૨–૨૦૨૩

કુલસચિવ

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા વિભાગીય વડાશ્રી.
..... આપશ્રીની કોલેજ/વિભાગના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

Veer Narmad South Gujarat University, Surat.

M. Sc. Chemistry Programme

Syllabus
M.Sc. Environmental Chemistry
Semester-IV

To Be Effective From November-2023
NEP 2020

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Name of Program	**Master of Science (Chemistry)**
Abbreviation	**M.Sc.**
Duration	**2 Years**
Eligibility Criteria	**Course- M.Sc. Environmental Chemistry** Eligibility: Graduation in Science with Chemistry or any subject equivalent to or allied to Chemistry.

M.Sc. Environmental Chemistry, Semester-IV

Theory Paper /Practical	Teaching schedule Hrs/week	Exam Schedule			Total marks	Credit
		Duration Hrs	Internal marks	External marks		
Theory papers:						
1) Core-1 (ECC-401) *Analysis of Water Pollutants*	4	3	30	70	100	4
2) Core-2 (ECC-402) *Air Analysis and Pollution Control Methods*	4	3	30	70	100	4
3) Core-3 (ECC-403) *Green Technology*	4	3	30	70	100	4
Inter/Multidisciplinary(AECC) 4) Elective Paper-1 (EEC-401) *Audit, Laws and Case Studies* **Or** Elective Paper-2 (EEC-402) *Environmental Management, Analysis And Effluents*	4	3	30	70	100	4
5) Skill Based Elective paper* /Swayam/MOOC courses (OSEC-401)	2	2	15	35	50	2
6) Practical (EP-401)	12	12	60	140	200	6
Total	30	26	195	455	650	24

***Common paper for all branches**

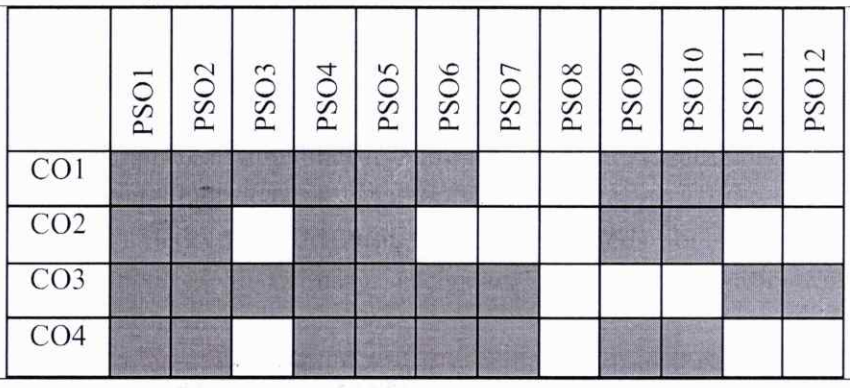
Evaluation Pattern		
No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%
2.	University Examination Practical Examination-2 days-6 h each day	70%

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology comprise classroom teaching, use of e-resources, library books, IT tools, encouraging students to participatein seminars/ workshops, presentations by students, assignments etc.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Master of Science, Chemistry
M.Sc. Environmental Chemistry, Semester-IV
NEP-2020
SYLLABUS TO BE EFFECTIVE FROM NOVEMBER-2023
Course Code- ECC-401
PAPER I: ANALYSIS OF WATER POLLUTANTS

Total Credits of the Course	**4**	**Hours per Week**	**4 hrs**

Course Objectives:	• To understand the detailed analysis of water on the basis ofColor, pH, Test, Odour, Hardness, TDS, Alkalinity, Chloride, Fluoride, Sulphate, Ammoniacal Nitrogen, Nitrite, Nitrate, Phosphate, Iron, Fluoride Heavy Metals, Silica. • To understand different treatment methods for waste water classified in primary, secondary and tertiary waste water treatment. • To learn which problems arise with industrial waste water and remedies. • To Understand fundamental & theory of the sources and available minerals in soils. Also learn the different approaches and classical as well as instrumental techniques used for the analysis.
Mapping between CO and PSO	

Unit	Description (4- Credit)
1.	**SAMPLING, PRESERVATION AND ANALYSIS** (15 Periods) Sampling and Preservation Methods. Significance, Analytical Methods, Interferences and their elimination, Modifications DO, BOD and COD, Color, pH, Test, Odour, Hardness, TDS, Alkalinity, Chloride, Fluoride, Sulphate, Cyanide, Ammoniacal Nitrogen, Nitrite, Nitrate, Phosphate, Iron, Fluoride, Heavy Metals, Silica.
2.	**WATER TREATMENT** (15 Periods) • **Water purification:** Natural Water PurificationProcesses- Treatment for Potable Water, Preliminary treatment, Primary treatment: Sedimentation, Flocculation.

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	• **Secondary treatment:** Trickling filters, Activated, Sludge, Tertiary treatment: Chlorination, Wet Oxidation, adsorption, Reverse Osmosis, Electrodialysis, Ion exchange and water disinfection. • **Sewage treatment:** Removal of Solids, metals (Ca, Fe, Mn), Removals of dissolved organic and inorganiccompounds, Sludge dewatering and disposal. • **Water management:** Water Reuse and Recycling, Rainwaterharvesting.
3.	**INDUSTRIAL WATER POLLUTION PROBLEMS AND REMEDIES** (15 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 • Electroplating Industry
4.	**SOIL ANALYSIS** (15 Periods) • pH, Moisture, Silica • Organic Carbon • Lime requirement of soil • Nitrogen analysis • Phosphorous analysis • Exchangeable Cation Analysis • Micro nutrient analysis • Trace element in soil analysis (Manganese, Sulphur, Magnesium) • Analysis of pesticides- Standard and polarographic analysis

Course Outcome: Having Completed this course, the learner will be able to	
1.	Understand Sampling methods and preservation DO, BOD and COD- Signification, Analytical Methods, Interferences and theirelimination, Modifications.
2.	To learn various water purification methods, sewage treatment, and water management.
3.	Water pollution occurs in different industries like Pharmaceutical Industry Fertilizers Industry, Pulp and Paper Industry, Sugar Industry, Distillery Industry, Textile Industry and its remedies with flowchart diagram.
4.	Understand the analysis of soil on the basis of pH, Lime requirement of soil, Nitrogen analysis, Phosphorous analysis, Exchangeable Cation Analysis, Micro nutrient analysis.

Suggested Reference 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

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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
7. Analytical Chemistry by Gurdeep R. Chatwal

On-line resources to be used if available as reference material

Master of Science, Chemistry
M.Sc. Environmental Chemistry, Semester-IV
NEP-2020
SYLLABUS TO BE EFFECTIVE FROM NOVEMBER-2023
Course Code- ECC-402
PAPER II: AIR ANALYSIS AND POLLUTION CONTROL METHODS

Total Credits of the Course	**4**	**Hours per Week**	**4 hrs**

Course Objectives:	• To study the analysis of gaseous air pollutants, air sampling methods, preservation of samples. • To learn Air pollution Control Methods and Equipment: Source, Collection methods, cleaning of gaseous effluent, particulate emission, absorption, adsorption, Odour control units • To study the Removal, Recovery and Destruction of SO_2, NO_2, H_2S, Organic Vapors and Particulates matters from production houses • To detailed study about bioremediation process.
Mapping between CO and PSO	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	■	■		■	■	■				■	■	■
CO2	■	■	■	■	■	■	■		■	■	■	■
CO3	■	■		■	■	■			■	■	■	
CO4	■	■			■	■			■	■		

Unit	Description (4- Credit)
1.	**ANALYSIS OF AIR POLLUTANTS** (15 Periods) • Sampling and preservation 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).

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	Analysis of Oxides of Sulphur, Nitrogen Oxygen and Carbon, H_2S, Mercaptans, Hydrocarbons, and Organics, Analysis of Particulate Matter,Direct Spectrophotometric Analysis of Gaseous Air Pollutants • Atmospheric Monitoring
2.	**AIR POLLUTION CONTROL METHODS AND EQUIPMENTS** (15 Periods) Air pollution Control Methods and Equipment: 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.
3.	**INDUSTRIAL AIR POLLUTION PROBLEMS AND REMEDIES** (15 Periods) • Removal, Recovery and Destruction of SO_2, NO_2, H_2S, Organic Vapours and Particulates matters from production houses. Petroleum refinery, Cement industries, Fertilizers Industry, Thermal power plants Iron and Steel industries, Chemical Process industries-Mineral Acid manufacturing and Chloralkali Plants, Microbial remediation of gases(Bio-filtration and bio-scrubbing).
4.	**BIOREMEDIATION** (15 Periods) • Microbial systems of bioremediation; factorsinfluencing bioremediation (Environmental, Physical and chemical factors),Types of bioremediation, Application of genetically engineered microorganisms for waste management, Microbial aerobic and anaerobicbio transformations, Bioremediation systems and processes (Solid, Liquid and Slurry phase) • Microbial detoxification of specialty chemicals(Insecticides, Herbicides, Fungicides, Polychlorinated biphenyls, Heavy metals, Xenobiotics).

Course Outcome: Having Completed this course, the learner will be able to	
1.	Understand the Analysis of Oxides of Sulphur, Nitrogen, Oxygen and Carbon, H_2S, Mercaptans, Hydrocarbons and Organics in different air sampling and compare the samples of different polluted areas.
2.	Learn about the different equipment like cyclone collector and dynamic precipitators; Electrostatic precipitators; wet and dry Scrubbers, filters.
3.	Learn the different air pollutants from Petroleum refinery, Cement industries, Fertilizers Industry, Thermal power plants, Iron and Steel industries, Chemical Process Industries-Mineral Acid manufacturing and Chloralkali Plants.
4.	Study about bioremediation process, systems, applications and Microbialdetoxification of specialty chemicals (Insecticides, Herbicides, Fungicides).

Suggested Reference Books:

1. Basic Concept of environmental Chemistry by Des. W. Connell.
2. Chemistry for environmental Engineering 4th Ed., By Sawyer, McCarty andParkin.
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 McGrawHill1, 998.

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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. CheremisinoffElesvier 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-Hill 1998.
10. M.N. Rao and H.V. Rao Air Pollution, Tata McGraw Hill Book Co. 1989.
11. Hand book of Air Pollution, Prevention and control: Nicholas P. Cheremisinoff Elsevier 2nd edition

On-line resources to be used if available as reference material

Master of Science, Chemistry
M.Sc. Environmental Chemistry, Semester-IV
NEP-2020
SYLLABUS TO BE EFFECTIVE FROM NOVEMBER-2023
Course Code- ECC-403
PAPER III: GREEN TECHNOLOGY

Total Credits of the Course	**4**	**Hours per Week**	**4 hrs**

Course Objectives:	• The goal of green tech is to protect the environment, repair damage done to the environment in the past, and conserve the Earth's natural resources • Its foremost objective is to protect and preserve the environment. Examples include technologies that recycle waste, purify water, or reduce pollution in water sources and air. But these aren't limited to industrial use and may apply to household items as well • Green nanotechnology has two goals: producing nanomaterials and products without harming the environment or human health, and producing nano-products that provide solutions to environmental problems. • To use Biocatalysis, to produce green buildings and use less hazardous substances in technology.
Mapping between CO and PSO	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	■	■	■	■	■	■	■				■	■
CO2	■	■		■	■	■				■	■	■
CO3	■	■	■		■	■			■	■	■	
CO4	■	■	■	■	■	■	■				■	■

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Unit	Description (4- Credit)
1.	**GREEN TECHNOLOGY** (15 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.
2.	**GREEN SYNTHETIC METHODS AND DESIGNS** (15 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.
3.	**GREEN NANOTECHNOLOGY** (15 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.
4.	**GREEN TECHNOLOGY APPLICATIONS** (15 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 and Pollution free engineering processes.

Course Outcome: Having Completed this course, the learner will be able to	
1.	Study 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.
2.	Understand the Catalytic methods in green synthesis, use of green solvents and solventless processes.
3.	Understand Nanomaterials and green nanotechnology, Fullerene, carbon nanotubes, Nanoparticles and its characterization.
4.	Understand how green technology is applicable in industries and other production methods, fuel cell and electric vehicles, solar energy and hydrogen production.

Suggested Reference 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

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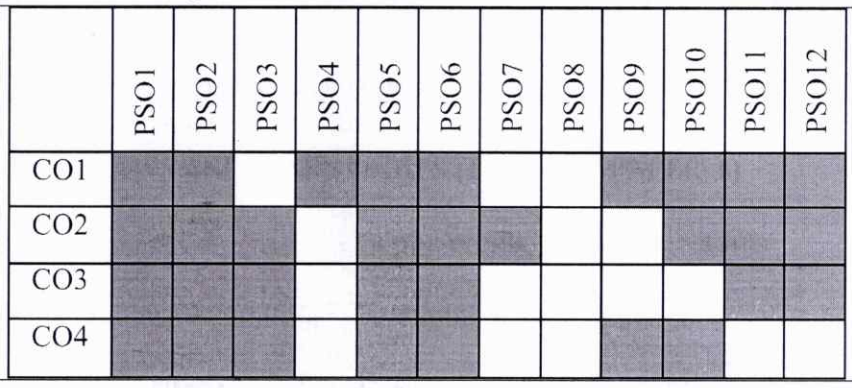
3. Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice. OxfordUniv. Press: Oxford.
4. Caye Drapcho, Nhuan Phú Nghiêm, Terry Walker (2008). Biofuels Engineering Process Technology. [McGraw-Hill].

On-line resources to be used if available as reference material

Master of Science, Chemistry
M.Sc. Environmental Chemistry, Semester-IV
NEP-2020
SYLLABUS TO BE EFFECTIVE FROM NOVEMBER-2023
Course Code- EEC-401
PAPER IV: AUDIT, LAWS AND CASE STUDIES (ELECTIVE PAPER-1)

Total Credits of the Course	**4**	**Hours per Week**	**4 hrs**

Course Objectives:	• To learn definition and terminologies of Environmental Impact Assessment. • To understand Pollution control boards, EPA-US, The Environment (Protection) Acts enacted by CPCB-India for water, air, noise and waste management. • To study the rules and acts for hazardous waste management. • To study the Environmental Movements and Case Studies
Mapping between CO and PSO	

Unit	Description (4- Credit)
1.	**ENVIRONMENTAL IMPACT ASSESSMENT** (15 Periods) • Definition and terminologies, Basic Description of EIA processes. Environmental facility and assessment and Audit. Elements and contents of EIA, Design of EIA, Environmental audits for sustainable development, Eco-labelling of environment friendly products, Environment Legislations of India
2.	**ENVIRONMENTAL PROTECTION LEGISLATIONS** (15 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

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	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.
3.	**ENVIRONMENTAL LEGISLATION: OBJECTIVES AND PROVISIONS OF RULES** (15 Periods) Municipal Solid Waste (Management and Handling Rules), 2000, 2016; Plastics Manufacture, Sale and Usage Rules, 2011; Recycled Plastics Manufacture and Usage Rules 2011, 2016; The Hazardous Wastes (Management, Handling and Trans boundary Movement) Rules, 2008; Bio-Medical Waste (Management & Handling) Rules,1998 ; E-waste Management and Handling Rules 2011; Noise Pollution (Regulation and Control) Rules, 2000 ; Coastal Regulation Zones (CRZ) Rules, 2011 and issues involved in enforcement of environmental legislation.
4.	**ENVIRONMENTAL MOVEMENTS AND CASE STUDIES** (15 Periods) • Chernobyl disaster, The Exxon Valdez Oil Spill, Bhopal gas Tragedy, Movements related to Environment Sacred groves, Bishnoi tradition, Chipko movement, Tehri dam, 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.

Course Outcome: Having Completed this course, the learner will be able to	
1.	Study detailed description about ENVIRONMENTAL IMPACT ASSESSMENT.
2.	To study the various acts for ENVIRONMENTAL PROTECTION LEGISLATIONS.
3.	To understand Description of the Environmental settling, Prediction and Assessment of impact on air, water, Noise and Biological environment.
4.	To understand the case studies of Movements related to Environment Sacred groves, Bishnoi tradition, Chipko movement, Tehridam, Narmada dam, Almatti dam, Silent Valley.

Suggested Reference Books:

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
4. A Textbook of Environment Chemistry and Pollution Control By S.S. Dara and Dr. D.D. Mishra

On-line resources to be used if available as reference material

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VEER NARMAD SOUTH GUJARAT UNIVERSITY

Master of Science, Chemistry
M.Sc. Environmental Chemistry, Semester-IV
NEP-2020
SYLLABUS TO BE EFFECTIVE FROM NOVEMBER-2023
Course Code- EEC-402
PAPER IV: ENVIRONMENTAL MANAGEMENT, ANALYSIS AND EFFLUENTS
(ELECTIVE PAPER-2)

Total Credits of the Course	**4**	**Hours per Week**	**4 hrs**

Course Objectives:	• To study the various steps for the environmental management system. • To study the various methods for the analysis of biological materials and xenobiotics • To learn various treatment method for industrial effluents. • To understand Pollution control and common effluent plants.
Mapping between CO and PSO	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	■	■		■	■	■			■	■	■	■
CO2	■	■	■		■	■	■			■	■	■
CO3	■	■	■		■	■					■	■
CO4	■	■	■		■	■			■	■		

Unit	Description (4- Credit)
1.	**ENVIRONMENTAL MANAGEMENT [ISO 14000]** Principles and elements for successful environmental management, elements of environmental management, creating an environmental management, environmental management commitment and policy, leadership in an environmental management system, environmental management system audit, steps for the registration to ISO 14000, preparing environmental management system for an organization.
2.	**ANALYSIS OF BIOLOGICAL MATERIALS AND XENOBIOTICS** (15 Periods) Introduction, Indicators of Exposure to Xenobiotics, Determination of Metals, Direct Analysis of Metals, Metals in wet-ashed Blood and Urine, Extraction of Metals for Atomics Absorption Analysis, Determination of Non-metals and Inorganic compounds, Determination pf Parent organic compounds, Measurement of Phase 1 and Phase 2 reaction Products, Determination of Adducts.
3.	**TREATMENT OF INDUSTRIAL EFFLUENT** (15 Periods) • Primary treatment: screening, neutralization, equalization, sedimentation and coagulation • Secondary treatment: aerobic biological - activated sludge process, oxidation pond, aerated lagoon, trickling filter, anaerobic digestion. • Tertiary treatment: removal of dissolved inorganic matter, organics (biodegradable &

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	other organics), oil & grease, acid and alkali, toxic material, carbon, nitrogen, phosphorus and microorganisms.
4.	**COMMON EFFLUENT TREATMENT PLANT** (15 Periods) • Introduction of ETP and CETP • Need for effluent treatment and principle of ETP • Common problems, design and management of CETP • Sources and characteristics of industrial waste water • Indian standards for disposal of industrial effluents

Course Outcome: Having Completed this course, the learner will be able to	
1.	To understand the environmental management systems, policies and steps for their registration.
2.	To understand Xenobiotics and their exposures, adducts and analysis of organic and inorganic compounds.
3.	Study in detail various types of treatment of industrial effluents dissolved like oily, undissolved matters by various methods.
4.	To study the various methods for the treatment of plants (ETP and CETP), problems, design and management.

Suggested Reference Books:

1. Analysis of cosmetics products, Ed. by A. Salvador and A. Chisvert, 2009, 9, 423-461
2. Environment impact assessment: David P Lawrence, Wiley inter-science 2003.
3. Environment impact assessment handbook: Barbara Carroll, Trevor Turpin, Thomas Telford 2003.
4. Environmental Chemistry by Stanley E. Manahan, 7th ed.
5. A Textbook of Environment Chemistry and Pollution Control By S.S. Dara and Dr. D.D. Mishra

On-line resources to be used if available as reference material

Master of Science, Environmental Chemistry
NEP-2020
SYLLABUS TO BE EFFECTIVE FROM NOVEMBER-2023
Semester-IV
Course Code- EP-401
PRACTICALS

Total Credits of the Course	**6**	**Hours per Week**	**12 hrs**

Course Objectives:	• Understand the importance of various instrumental techniques in analysis. • To learn about the calculation in analysis. • To learn about the stoichiometry used in analysis of compounds. • Preparation of solution used in determination of various compounds.
Mapping between CO and PSO	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1												
CO2												
CO3												
CO4												

Course Content	
Major Exercise	4-Credit
Viva-Voce	
Minor Exercise	4-Credit
Minor Exercise & Spectral Interpretation	

Major Exercise: (Minimum 6)

1. Analysis of dolomite ore by gravimetry.
2. Separation of Zn^{+2}& Mg^{+2} ion by an anion exchange resin.
3. Potentiometric determination of Chloride, Bromide, Iodide and Fluoride in a mixture.
4. Analysis of Pyrolusite ore for the major constitute.
5. Determination of Cr and Mn in a steel sample photo spectrometry.
6. Determination of the Chemical Oxygen Demand (COD) value of KHP sample using conventional method.
7. Determination of the Dissolved Oxygen (DO) in given water sample by modified Winkler's method.
8. Analysis of Ammoniacal Nitrogen in water sample.
9. Determination of Kjeldahl Nitrogen in soil sample.

Minor Experiments: (Minimum 8)

1. Determination of the thiosulphate in a given solution

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2. Analysis of dye intermediate containing $-NH_2$ by Potentiometric titration.
3. Determination of Nitrite spectrophotometrically.
4. Biuret in the sample of urea.
5. Determination of fluoride in a given solution / tooth paste by Zirconyl-Alizarin redmethod colorimetrically.
6. Analysis of organic materials: Glycerol, Glycine, phenol.
7. Determination of the % of Ca & Mg both combined volumetrically.
8. Estimation of Fe by colorimetry.
9. Determination of the concentration of Cr^{+3} and Co^{+2} in a given mixture using spectrophotometer.
10. Titrimetric determination of L-ascorbic acid. (Vitamin C)
11. Determination of the individual concentration of Cu^{+2} and Ca^{+2} in a mixture using by EDTA solution and complexometric titration.
12. Determination of Ka_1 and Ka_2 of phosphoric acid.
13. Determination of Ca present in $CaCO_3$ with Vitamin D_3 tablet using EDTA byvolumetrically.

Spectral Interpretation (Minimum 10 from syllabus)

Structure interpretation of drugs intermediate from spectra (functional groups and low molecular weight compounds determination only from UV, IR, NMR and Mass)

Course Outcome: Having Completed this course, the learner will be able to	
1.	Understand the basics of practical.
2.	Understand reaction and monitoring specified reaction condition.
3.	Learn to work-up after the completion of practical.
4.	Confirm the results with the references.
5.	Understand the calculation with reference to respective factors.
6.	Appreciate good laboratory practices.

Suggested Reference Books:

1. Vogel's Textbook of quantitative analysis fifth edition by Longman scientific and technical, UK.
2. Indian Pharmacopeia, Vol-I, II and III.
3. Standard methods of Chemical analysis sixth edition edited by Frank J. Welcher by D. VanNostrand Company, Inc.

On-line resources to be used if available as reference material

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