Babu Banarasi Das University, Lucknow

Department of Civil Engineering

School of Engineering

Master of Technology (Environmental Engineering) - Regular

Evaluation Scheme (w.e.f from session 2019-20)

SEMESTER I									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
C	MAS3106	Applied Mathematics	4	0	0	40	60	100	4
C	MEV3101	Environmental Chemistry and Microbiology	4	0	0	40	60	100	4
C	MEV3102	Water Treatment and Distribution	4	0	0	40	60	100	4
C	MEV3103	Wastewater Treatment	4	0	0	40	60	100	4
GE	GE37011/ GE37014	Generic Elective - I	4	0	0	40	60	100	4
C	MEV3151	Water and Waste Water Treatment Lab	0	0	2	100	0	100	1
C	MEV3152	Seminar	0	0	2	100	0	100	1
C	MEV3153	Technical Paper Writing	0	0	2	100	0	100	1
Total			**20**	**0**	**6**	**500**	**300**	**800**	**23**

Legends:

L Number of Lecture Hours per week
T Number of Tutorial Hours per week
P Number of Practical Hours per week
CIA Continuous Internal Assessment
ESE End SemesterExamination

Category of Courses:

C Core Course
GE Generic Elective

BabuBanarasi Das University, Lucknow

Department of Civil Engineering

School of Engineering

Master of Technology (Environmental Engineering) - Regular

Evaluation Scheme (w.e.f from session 2019-20)

SEMESTER II									
Course Category	**Course Code**	**Code Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	MEV3201	Solid Waste Management	4	0	0	40	60	100	4
C	MEV3202	Air and Noise Pollutionand Control	4	0	0	40	60	100	4
C	MEV3203	Environmental Quality Management	4	0	0	40	60	100	4
GE	GE37021/ GE37024	Generic Elective - II	4	0	0	40	60	100	4
GE	GE37031/ GE37034	Generic Elective - III	4	0	0	40	60	100	4
C	MEV3251	Air andNoise PollutionLab	0	0	2	100	0	100	1
C	MEV3252	Seminar	0	0	2	100	0	100	1
C	MEV3253	Technical Paper Presentation	0	0	2	100	0	**100**	**1**
Total			**20**	**0**	**6**	**500**	**300**	**800**	**23**

Legends:

L Number of Lecture Hours per week
T Number of Tutorial Hours per week
P Number of Practical Hours per week
CIA Continuous Internal Assessment
ESE End SemesterExamination

Category of Courses:

C CoreCourse**GE**
GenericElective

BabuBanarasi Das University, Lucknow

Department of Civil Engineering

School of Engineering

Master of Technology (Environmental Engineering) - Regular

Evaluation Scheme (w.e.f from session 2019-20)

SEMESTER III									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
C	MEV3351	State of the Art Seminar#	-	-	-	200	0	200	4
C	MEV3352	Thesis – I*	-	-	-	400	0	400	16
Total			**-**	**-**	**-**	**600**	**0**	**600**	**20**

\# Student need to perform a literature survey and will give a state of the art presentation and will submit a synopsis clearly mentioning the problem statement. The presentation and synopsis will be evaluated internally within two months of the start of the semester and the result will be intimated to the students so as to proceed for thesis.

* Student will develop the workable model for the problem they have supposed insynopsis.

SEMESTER IV									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
C	MEV3451	Thesis – II**	-	-	-	200	800	1000	28
Total			**-**	**-**	**-**	**200**	**800**	**1000**	**28**

** (a) Thisis in continuation with Thesis -I.

(b) The required experimental / mathematical verification of the proposed model will be done in thissemester.

Legends:

L Number of Lecture Hours per week

T Number of Tutorial Hours per week

P Number of Practical Hours per week

CIA Continuous Internal Assessment

ESE End SemesterExamination

Category of Courses:

C Core Course

GE Generic Elective

BabuBanarasi Das University, Lucknow

Department of Civil Engineering

School of Engineering

Master of Technology (Environmental Engineering) - Regular

Evaluation Scheme (w.e.f from session 2019-20)

Course Code	GenericElective-I
GE37011	Earth and Environment
GE37012	Environmental Sanitation and Ecology
GE37013	Renewable Sources of Energy
GE37014	Instrumental Method of Analysis

Course Code	Generic Elective-II
GE37021	Environmental Remote Sensing
GE37022	Water Pollution
GE37023	Rural Environmental Technology
GE37024	Environmental Impact Assessment

Course Code	Generic Elective-III
GE37031	Ground Water Management
GE37032	Ground Water Hydrology
GE37033	Design of Water Supply Systems
GE37034	Industrial Wastewater Treatment

BabuBanarasi Das University, Lucknow

Department of Civil Engineering

School of Engineering

Master of Technology (Environmental Engineering) - Regular

Evaluation Scheme (w.e.f from session 2019-20)

Credit Summary Chart						
Course Category	**Semester**				**Total Credits**	**%age**
	I	**II**	**III**	**IV**		
C	**19**	**15**	**20**	**28**	**82**	**87.234**
GE	**4**	**8**			**12**	**12.766**
Total	**23**	**23**	**20**	**28**	**94**	**100**

Discipline wise Credit Summary Chart						
Course Category	**Semester**				**Total Credits**	**%age**
	I	**II**	**III**	**IV**		
Engg. Sciences	**4**				**4**	**4.255**
Professional Subject Core	**13**	**13**			**26**	**27.660**
Professional Subject-Generic Elective	**4**	**8**			**12**	**12.766**
Thesis, Seminar	**2**	**2**	**20**	**28**	**52**	**55.319**
Total	**23**	**23**	**20**	**28**	**94**	**100**

Legends:

L Number of Lecture Hours per week

T Number of Tutorial Hours per week

P Number of Practical Hours per week

CIA Continuous Internal Assessment

ESE End Semester Examination

Category of Courses:

C CoreCourse

GE GenericElective

BabuBanarasi Das University, Lucknow

Department of Civil Engineering

School of Engineering

Master of Technology (Environmental Engineering) – Part Time

Evaluation Scheme (w.e.f from session 2019-20)

SEMESTER I									
Course Category	**Course Code**	**Code Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	MAS3106	Applied Mathematics	4	0	0	40	60	100	4
C	MEV3101	Environmental Chemistry and Microbiology	4	0	0	40	60	100	4
C	MEV3102	Water Treatment and Distribution	4	0	0	40	60	100	4
Total			**12**	**0**	**0**	**120**	**180**	**300**	**12**

Legends:

L Number of Lecture Hours per week

T Number of Tutorial Hours per week

P Number of Practical Hours per week

CIA Continuous Internal Assessment

ESE End Semester Examination

Category of Courses:

C CoreCourse

GE GenericElective

BabuBanarasi Das University, Lucknow

Department of Civil Engineering

School of Engineering

Master of Technology (Environmental Engineering) – Part Time

Evaluation Scheme (w.e.f from session 2019-20)

SEMESTER II									
Course Category	**Course Code**	**Code Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	MEV3201	Solid Waste Management	4	0	0	40	60	100	4
C	MEV3202	Air and Noise Pollution and Control	4	0	0	40	60	100	4
C	MEV3203	Environmental Quality Management	4	0	0	40	60	100	4
Total			**12**	**0**	**0**	**120**	**180**	**300**	**12**

Legends:

L Number of Lecture Hours per week

T Number of Tutorial Hours per week

P Number of Practical Hours per week

CIA Continuous Internal Assessment

ESE End Semester Examination

Category of Courses:

C CoreCourse

GE GenericElective

BabuBanarasi Das University, Lucknow

Department of Civil Engineering

School of Engineering

Master of Technology (Environmental Engineering) – Part Time

Evaluation Scheme (w.e.f from session 2019-20)

SEMESTER III									
Course Category	**Course Code**	**Code Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	MEV3103	Wastewater Treatment	4	0	0	40	60	100	4
GE	GE36911/ GE36914	Generic Elective - I	4	0	0	40	60	100	4
C	MEV3151	Water and Waste Water Treatment Lab	0	0	2	100	0	100	1
C	MEV3152	Seminar	0	0	2	100	0	100	1
C	MEV3153	Technical Paper Writing	0	0	2	100	0	100	1
Total			**8**	**0**	**6**	**380**	**120**	**500**	**11**

Legends:

L Number of Lecture Hours per week

T Number of Tutorial Hours per week

P Number of Practical Hours per week

CIA Continuous Internal Assessment

ESE End Semester Examination

Category of Courses:

C CoreCourse

GE GenericElective

BabuBanarasi Das University, Lucknow

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School of Engineering

Master of Technology (Environmental Engineering) – Part Time

Evaluation Scheme (w.e.f from session 2019-20)

SEMESTER IV									
Course Category	**Course Code**	**Code Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
GE	GE36921/ GE36924	Generic Elective - II	4	0	0	40	60	100	4
GE	GE36931/ GE36934	Generic Elective - III	4	0	0	40	60	100	4
C	MEV3251	Air andNoise PollutionLab	0	0	2	100	0	100	1
C	MEV3252	Seminar	0	0	2	100	0	100	1
C	MEV3253	Technical Paper Presentation	0	0	2	100	0	100	1
Total			**8**	**0**	**6**	**380**	**120**	**500**	**11**

Legends:

L Number of Lecture Hours per week

T Number of Tutorial Hours per week

P Number of Practical Hours per week

CIA Continuous Internal Assessment

ESE End Semester Examination

Category of Courses:

C CoreCourse

GE GenericElective

BabuBanarasi Das University, Lucknow

Department of Civil Engineering

School of Engineering

Master of Technology (Environmental Engineering) – Part Time

Evaluation Scheme (w.e.f from session 2019-20)

SEMESTER V									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
C	MEV3351	State of the Art Seminar#	-	-	-	200	0	200	4
C	MEV3352	Thesis – I*	-	-	-	400	0	400	16
Total			**-**	**-**	**-**	**600**	**0**	**600**	**20**

\# Student need to perform a literature survey and will give a state of the art presentation and will submit a synopsis clearly mentioning the problem statement. The presentation and synopsis will be evaluated internally within two months of the start of the semester and the result will be intimated to the students so as to proceed for thesis.

* Student will develop the workable model for the problem they have supposed insynopsis.

SEMESTER VI									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
C	MEV3451	Thesis – II**	-	-	-	200	800	1000	28
Total			**-**	**-**	**-**	**200**	**800**	**1000**	**28**

** (a) This is in continuation with Thesis -I.

(b) The required experimental / mathematical verification of the proposed model will be done in thissemester.

Legends:

L Number of Lecture Hours per week

T Number of Tutorial Hours per week

P Number of Practical Hours per week

CIA Continuous Internal Assessment

ESE End Semester Examination

Category of Courses:

C CoreCourse

GE GenericElective

BabuBanarasi Das University, Lucknow

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School of Engineering

Master of Technology (Environmental Engineering) – Part Time

Evaluation Scheme (w.e.f from session 2019-20)

Course Code	Generic Elective-I
GE36911	Earth and Environment
GE36912	Environmental Sanitation and Ecology
GE36913	Renewable Sources of Energy
GE36914	Instrumental Method of Analysis

Course Code	Generic Elective-II
GE36921	Environmental Remote Sensing
GE36922	Water Pollution
GE36923	Rural Environmental Technology
GE36924	Environmental Impact Assessment

Course Code	Generic Elective-III
GE36931	Ground Water Management
GE36932	Ground Water Hydrology
GE36933	Design of Water Supply Systems
GE36934	Industrial Wastewater Treatment

Credit Summary Chart								
Course Category	**Semester**						**Total Credits**	**%age**
	I	**II**	**III**	**IV**	**V**	**VI**		
F								
C	12	12	7	3	20	28	82	**87.23**
GE			4	8			12	**12.77**
Total	**12**	**12**	**11**	**11**	**20**	**28**	**94**	**100**

Discipline wise Credit Summary Chart								
Course Category	**Semester**						**Total Credits**	**%age**
	I	**II**	**III**	**IV**	**V**	**VI**		
Engg. Sciences	4						4	**4.26**
Professional SubjectCore	8	12	4	1			25	**26.59**
Professional Subject - Generic Elective			4	8			12	**12.76**
Thesis, Seminar			3	2	20	28	53	**56.39**
Total	**12**	**12**	**11**	**11**	**20**	**28**	**94**	**100**

Legends:

L Number of Lecture Hours per week

T Number of Tutorial Hours per week

P Number of Practical Hours per week

CIA Continuous Internal Assessment

ESE End Semester Examination

Category of Courses:

C CoreCourse

GE GenericElective

MEV3101 ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

Course Objective:

1. To familiarize the students with the basics of environmentalchemistry.

2. To understand the concept and application of microbial contamination ofwater.

3. Study about the different –phases of microbialgrowth.

4. To have knowledge of bio-techniques on environment.

Learning Outcome:

1. To learn the basic principles of environmentalchemistry.
2. Detailed knowledge of different parameter of water and wastewater.
3. To know the thermodynamics microbialsystem.
4. Detailed knowledge of concentration of water, aerobic and anaerobic process.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Chemistry of Water, physical properties, hydrogen bonding in biological systems, changesinwater properties by addition of solute.	30 Hours	1
II	**Colloidal Chemistry** Enzymes,enzyme metabolism, biosynthesis of DNA and RNA, cloning of DNA **Hydrocarbon** Chemistry of hydrocarbon decay, environmental effects, effectson macro and micro- organisms.	30 Hours	1
III	**Physio-chemicalparameters** Definition and determination of conductivity, pH, COD, BOD, Viscosity,surface tension, estimation of various elements at major, minor trace, concentrations; Choice of a technique; Principle, merits and demerits of the techniques– calorimetry,AtomicAbsorptionSpectroscopy, Gas chromatography.	30 Hours	1

IV	Thermodynamics of Microbial systems, Mass and Energy Balance, Microbial Process, Aerobic and Anaerobic Microbial growth.	30 Hours	1

References:

1. MaierR.M., "Environmental Microbiology",Academic Press, New York,1999

2. Moore. J. W. and MooreE. A. "Environmental Chemistry" McGrawHill

3. Sawyer C.N., McCarty PL and Parkin G.F, "Chemistry for Environmental Engineers", 4thEdition, McGraw Hill, New Delhi, 1994.

MEV3102 WATER TREATMENT AND DISTRIBUTION

Course Objective:

1. To know the different terminology used in water treatment and distributionprocesses.
2. Learn about the various parameters ofwater.
3. Detailed study about the physico-chemical methods involved in water treatmentprocess.
4. To know about the advance treatment process like reverse osmosis process.

Learning Outcome:

1. Describe the basis for the selection of different treatment steps in drinking water production.
2. To understand the different parameter of water.
3. Detailed knowledge of designing of waterplant.
4. To analyze the water and waste water characteristics.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Sources of Water, different methods of Population Forecasting and Water Requirement	30 Hours	1
II	**Water Quality Parameters** Physical, Chemical and Biological **Treatment Process** Solid Separation, Settling Operation, Design of settling tank, strokes law, Coagulation, flocculation, clariflocculator	30 Hours	1
III	**Treatment Process** Filtration, theory of filtration ,rapid sand filter, slow sand filter, pressure filter, Softening,Disinfection, chlorination, Desalination, Dissolved SolidsRemoval,	30 Hours	1
IV	**Miscellaneous Treatment and Distribution System** Adsorption and Ion Exchange, Electrolysis, Osmosis,Special Treatments, Pumping and	30 Hours	1

	Distribution Systems hardy cross method and pipe networks		

References:

1. Garg S.K., “Water Supply Engineering (Environmental Engineering Vol. – I)”, KhannaPublication
2. Peavy, “Environmental Engineering”, McGraw Hill
3. Sawyer C.N, McCarty P.L and Parkin G.F, “Chemistry for Environmental Engineering and Science”, 5th ed. TataMcGraw-Hill
4. Manual of water supply

MEV3103 WASTE WATER TREATMENT

Course Objective:

1. To know the different terminology used in waste waterprocess
2. Learn about the various parameters of wastewater
3. Detailed study about the physico-chemical methods involved in waste water treatmentprocess.

Learning Outcome:

1. To know about the waste water treatmentprocesses.
2. To understand the differentphysico-chemical parameter of waste water.
3. To develop knowledge about designing of different waste water treatment units.
4. To analyze the industrial waste water and learn itscharacteristics.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Waste Water Characteristics** Constituent of sewage physical & chemical, oxygen demand, BOD, COD, Relative Stability, population equivalent, BiologicalCharacteristics.	30 Hours	1
II	**Waste Water Treatment** Flow diagram of conventional sewage, treatment plant, Primary treatment – screens, Grit Chambers, detritus tank, skimming tank, Sedimentation – Plain & Chemical. **Secondary Treatment** Trickling fitters, Biological contactor, Activated sludge process, aerobic pondand ditches,facultative pond, anaerobic ponds- polishing ponds, aerated lagoon.	30 Hours	1
III	**Anaerobic digestion of sludge** Design of low and high rate anaerobic digesters and septic tank, soak pit, soak trench. Basic concept of anaerobiccontactprocess, anaerobic filter	30 Hours	1
IV	Anaerobic fixed film reactor, fluidized bed andExpanded bed reactors and up flow anaerobic sludge blanket (UASB) reactor, sludge digestionandsludge disposal.	30 Hours	1

References:

1. ArceivalaS.J., “Wastewater Treatment for Pollution Control”, TMH,New Delhi,Second Edition,2000.
2. Manualon“Sewerage and Sewage Treatment” CPHEEO, Ministryof UrbanDevelopment, Government of India, New Delhi,1999.
3. Metcalf & Eddy, INC, “Wastewater Engineering – Treatment and Reuse”, FourthEdition, Tata McGraw-Hill Publishing Company Limited, New Delhi,2003.
4. SawyerC.N, McCarty P.L and ParkinG.F, “Chemistry for Environmental Engineeringand Science”, 5th ed. TataMcGraw-Hill.

MEV3151 WATER AND WASTE WATER LAB

List of Experiments

1. To estimate the hardness of the given watersample.
2. To estimate the pH and electrical conductivity of the given watersample.
3. To estimate the acidity and alkalinity of the given watersample.
4. To estimate the chloride concentration of the given watersample.
5. To estimate the total solids, total dissolved solids and volatile solids of the given watersample.
6. To determine the BOD, COD of the givensample.
7. To verify Class I, Class II, Class IIIsedimentation.
8. To estimate the fluoride concentration of the given watersample
9. To determine MPN count - total andfecal.
10. To determine Heavy Metals (Cr, As, CN, Cd) in wastewater.

MEV3201 SOLID WASTE MANAGEMENT

Course Objective:

1. To have knowledge of solid waste and management.
2. Study the properties of solid wastes and their different reductiontechniques.
3. To study how to handlesolidwastes.
4. Discuss the significance of recycling, reuse and reclamation of solid wastes.

Learning Outcome:

1. Illustrate industrial practices in solid waste management.
2. Detailed knowledge on properties of hazardouswaste.
3. To know the handling and transportation techniques for solid and hazardous wastes.
4. Students will be able to know processing and handling of solid waste in better way.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Sources and Classification of Solid Waste** Types and Sources of solid and hazardous wastes, Need for solid and hazardous waste management, Elements of integrated waste management and roles of stakeholders, Salient features of Indian legislations on management and handling of municipal solidwastes, hazardous wastes, biomedical wastes, lead acid batteries, electronic wastes , plastics and fly ash – Financing wastemanagement	30 Hours	1
II	**Waste Characterization and Source Reduction** Waste generation rates and variation - Composition, physical, chemical andbiologicalpropertiesofsolidwastes Hazardous Characteristics, TCLP tests, waste sampling and characterization plan, Source reduction of wastes, Wasteexchange,Extendedproducerresponsibility,	30 Hours	1

	Recycling andreuse		
III	**Storage, Collection and Transport of Wastes** Handling and segregation of wastes at source storage and collection of municipal solidwastes, Analysis of Collection systems **Need for transfer and transport** Transferstations Optimizing waste allocation, compatibility, storage, labeling and handling ofhazardous wastes – hazardous waste manifests and transport **Waste Disposal** Waste disposal options – Disposal in landfills - Landfill Classification, types and methods– site selection - design and operation of sanitary landfills, secure landfills and landfillbioreactors, leachate and landfill gas management, landfill closure andEnvironmentalmonitoring	30 Hours	1
IV	**Waste Processing Technologies** Objectives of waste processing, material separation and processing technologies, biological and chemical conversion technologies, methods and controls of Composting- thermal conversion technologies and energy recovery, incineration	30 Hours	1

References:

1. T. Hilary and Samuel A, Vigil, "Integrated Solid Waste Management", Mc-Graw Hill International edition, NewYork

2. LaGrega M., Philip L .Buckingham, "Hazardous waste Management", Mc-Graw HillInternational edition, NewYork

3. CPHEEO, "Manual on Municipal Solid waste management, Central Public Healthand Environmental Engineering Organisation , Government of India, New Delhi

4. Vesilind&Worrell, “Solid waste Engineering” Thomsonb Learning Inc., Singapore

MEV3202 AIR AND NOISE POLLUTION AND CONTROL

Course Objective:

1. To familiarize the students with the basics of air pollution including atmospheric physics and chemistry.
2. Recognize and explain different types of air pollutants in industry.
3. To apply these concepts to Air and noise Pollution Control and Environmental Management.
4. To discuss effects of air pollution on humans, animals and plants.

Learning Outcome:

1. Students shall be capable of understanding the importance of air and noise pollution.
2. Detailed knowledge to study air pollutant and standardemissions.
3. They shall be able to model the air and noise pollution and design control devices.
4. Know about the fundamentals of noise pollution and itscontrol.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction:Atmosphere** Definition, Scope and Scales of Air Pollution– Sources and classification of air pollutants and their effect on human health,vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality andEmission standards, Air Pollution Indices – Emission Inventories, Ambient and stacksampling and Analysis of Particulate and Gaseous Pollutants.	30 Hours	1
II	**Meteorology** Effects of meteorology on Air Pollution Fundamentals,Atmospheric stability, Inversion,Wind profiles and stack plume patterns-Atmospheric Diffusion Theories – Dispersionmodels, Software application, Plume rise, Effective stack height	30 Hours	1

	Control of Gaseous Contaminants Factors affecting Selection of Control Equipment Working principle, Design andperformance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters		
III	**Control of Particulate Contaminants** Factors affecting Selection of Control Equipment, Gas Particle Interaction, Workingprinciple, Design and performance equations of Gravity Separators (cyclone),Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators, Operational Considerations, Process Control and Monitoring, Costing of APCequipment – Case studies for stationaryand mobile sources.	30 Hours	1
IV	**Noise Pollution And Control** Definition of decibel, sound power level, sound intensity level and sound pressure level; measurement of noise level;sound meter basic concept of community noise, transportation noise and industrial noise; acceptable outdoor and indoor noise levels; effects of noise and controlmeasures, Basics of noise barriers.	30 Hours	1

References:

1. Nevers N. " Air Pollution Control Engineering", McGraw Hill, NewYork,

2. David.H.F,BelaG., "Air Pollution", LweisPublishers.

3. AnjaneyuluY., "Air Pollution and Control Technologies", Allied Publishers (P)Ltd., India

4. SternArthur C, "Air Pollution (Vol.I – Vol.VIII) ", Academic Press NewDelhi

5. Warner F., Wark K. "Air Pollution: Its Origin and Control (3rd Edition)" Prentice Hall publication

6. Seinfeld J. H. "Atmospheric Chemistry and Physics of Air Pollution" John Wiley &. Sonspublication

MEV3203 ENVIRONMENTAL QUALITY MANAGEMENT

Course Objective:

1. To develop an understanding of international environmental standards
2. Conduct Mock Auditing.
3. To develop and apply ISO 14000 for Environmental Management
4. To develop basic knowledge on components of ISO 14000

Learning Outcome:

1. Ability to understand the need and origin of Environmental Management Standards
2. Detailed knowledge of spectroscopictechniques.
3. Ability to identify environmental aspects and impacts.
4. Identify global and national eco labels.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Environmental impact assessment** Introduction, Concepts and aims, Impact statement,Methods and Processes, Mitigation processes.Prediction and assessment of impact on air, water and noise. Public participation in environment decisionmaking	30 Hours	1
II	**Environment education and economics** Environment education and awareness, Environmental economics, Economics of Pollution control, Cost benefit analysis. Prediction and assessment of impacts on the biological, cultural and socio-economic environment, Introduction and basic concepts. Environmental impact assessment of major development projects	30 Hours	1
III	**Environmental Audit** Concepts, Objectives of audit. Types of audits, programme, Audit Report, Action Plan & Management of audits. Waste management contractor audits, Lifecycleapproach	30 Hours	1

IV	**Introduction to ISO** Principles and Elements of Successful environmental management. ISO Principles,EMS, Creating an environmental management system in line with ISO 14000, general principle of conducting life cycle assessment (LCA), definition, stages and scope of LCA and LCA inventory.	30 Hours	1

References:

1. Willard Dean.And Settle. „Instrumental methods of analysis Edn. Words Worth, New York, 2004.
2. PaulR, "Environmental Quantitative Analysis: Principles, Techniques, and Applications", Marcel Dekker; 1edition
3. Ewing, "Instrumental Methods of Chemical Analysis", 5th Edition, McGraw Hill, NewYork

MEV3251 AIR AND NOISE POLLUTION LAB

1. Measurement of PM_{10} and$PM_{2.5}$
2. Measurement of$PM_{2.5}$
3. Measurement of CO and HC inexhausts.
4. Measurements of SO_2 in ambientair.
5. Measurement of NO_2in ambientair.
6. Stack monitoring by BIS/EPA methods by fieldvisit.
7. Detection of levels of noise pollution in residential, commercial, industrial and sensitive areas of Lucknow city.
8. Measurement of H_2S, $O_3$and NH_3 in ambientair
9. Plotting of windrose diagram by AERMODsoftware

GE37011/GE36911EARTH AND ENVIRONMENT

Course Objective:

1. Recognize the natural and human-driven systems and processes that produce energy and affect the climate
2. Explain scientific concepts in language non-scientists can understand
3. Use numerical tools and publicly available scientific data to demonstrate important concepts about the Earth, its climate, and resources
4. Demonstrate that greenhouse gases are the most significant factor controlling surface temperature

Learning Outcome:

1. Recall that carbon dioxide has a well-understood and physically unavoidable warming influence on Earth's climate
2. Recall that multiple independent records from different places using different methods all show that both CO_2 and temperature are rising
3. Explain that patterns of global warming in the past century can only be reproduced by considering both natural and human influences on climate
4. Use a model to show that global climate always finds a steady state, but certain factors may influence how long it takes to get there

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Introduction, Structure and composition of Atmosphere, component of environment, Importance of Clean Environment, Ecosystem, Ecological Pyramid.	30 Hours	1
II	Conservation of Environment, Source, Cause and Effect of Thermal Pollution, Radioactive and Non-Radioactive Pollution.	30 Hours	1
III	Source,Cause and Effect Soil and Land Pollution, Impact of Mining and Deforestation, Green House Effect and Global Warming, Depletion of Ozone.	30 Hours	1
IV	Biodiversity, Sustainable Development, e-Waste, Plastic Waste. Land filling, Underground water pollution.	30 Hours	1

References:

1. Mukherjee Biswarup, "Environmental Biology", Tata McGraw Hill Publishing Company Limited, New Delhi,1997

2. Manohaan S.E., "Environmental Science and Technology", Lewis Publication, NewYork,1997

3. Sawyer C.N., P.L. McCartyand, G.F Parkin,. "Chemistry for Environmental Engineers", 4thEdition, McGraw Hill, New Delhi,1994

4. DeA.K, "Environmental Chemistry", New Age International Limited, New Delhi,1995

GE37012/GE36912ENVIRONMENTAL SANITATION AND ECOLOGY

Course Objective:

1. To know the different terminology used insanitation.
2. To know about basics of theecosystem.
3. Gives the knowledge of solid wastemanagement.
4. To know about the biologicalprocess.

Learning Outcome:

1. Exposure on the basic concepts of pollution and itseffects.
2. Detailed study about solid wastemanagement.
3. To know about the biologicalprocess.
4. Awareness of different programme running bygovernment.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Introduction and terminology, Pollution types and Sources, Health Hazards,	30 Hours	1
II	Water Supply and Sanitary Installations in Buildings, Ecology and Environment, Principles of Ecology, Ecosystems, Energy Flow, Trophic Level, Food chain and Food Web, Eco-cycles of Pollutants and Species	30 Hours	1
III	Waste disposal options – Disposal in landfills - Landfill Classification, types and methods– site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation	30 Hours	1
IV	Various problems in implementation of sanitationscheme in lndia. Biogas plants, roleof W.H.O. in rural sanitation of India.	30 Hours	1

References:

1. MukherjeeBiswarup, “Environmental Biology”, Tata McGraw Hill Publishing CompanyLimited, New Delhi,1997

2. ManohaanS.E.,“Environmental Science and Technology”, Lewis Publication, New York,1997

3. SawyerC.N., McCarty P.L.and. ParkinG.F, “Chemistry for Environmental Engineers”, 4thEdition, McGraw Hill, New Delhi,1994

4. DeA.K., “Environmental Chemistry”, New Age International Limited, New Delhi,1995

GE37013/GE36913RENEWABLE SOURCES OF ENERGY

Course Objective:

1. To learn the basic concept of renewable energyresource.
2. To study the about solar energy, tidal energy, wind energyetc.
3. Detailed study of nuclear energy, hydrogenenergy.
4. To develop greentechnology.

Learning Outcome:

1. Learn conventional and nonconventional type of energyresource.
2. To enhance knowledge about different renewable resources like solarenergy, tidal energyetc.
3. To study about lithiumcell.
4. To analyze characteristics of LNG andCNG.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Introduction to Renewable Sources of Energy, Wind energy, Ocean and tidal energy, etc.	30 Hours	1
II	**Solar Radiation** Measurements of solar Radiation and sunshine, Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solarCells – PV Systems – PV Applications..	30 Hours	1
III	**Wind Data and Energy Estimation** Wind Energy Conversion Systems – Wind Energygenerators and its performance – Wind Energy Storage it's Applications, Hybrid systems	30 Hours	1
IV	Hydrogen, generation, storage, transport and utilization, Applications : power generation,transport – Fuel cells – technologies, types – economics and the power generation LPG/ CNG, Bio-Diesel.	30 Hours	1

References:

1. BoyleG., “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K.,1996
2. Twidell, J.W. & Weir, “Renewable Energy Sources”, EFN Spon Ltd., UK, 1986
3. TiwariG.N., “Solar Energy–Fundamentals Design,Modelling and applications”, Narosa Publishing House, New Delhi,2002
4. FrerisL.L., “Wind Energy Conversion systems”, Prentice Hall, UK,1990
5. SukhatmeS.P., “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi,1997

GE37014/GE36914INSTRUMENTAL METHOD OF ANALYSIS

Course Objective:

1. To learn the basic concept of quantitativechemistry.

2. To study the about photometry,chromatography.

3. To develop greentechnology.

4. To study aboutColorimetry.

Learning Outcome:

1. To learn the basic concept of X-RayFluorescence.

2. To study the aboutChromatography.

3. To develop greentechnology.

4. To learn NMRtechnique.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Concepts of Quantitative Chemistry, Electron Paramagnetic Resonance, X-Ray Fluorescence.	30 Hours	1
II	**Spectoscopy** Infrared Spectroscopy, Emission Spectroscopy, Flame Photometry, UV-Visible spectroscopy, Atomic Absorption Spectroscopy, Nephelometry and Turbidimetry, Gas Chromatography.	30 Hours	1
III	Gas-Solid Chromatography, Gas-Liquid Chromatography, High Pressure Liquid Chromatography, Polarography, Voltametry and Chronopotentiometry, Colorimetry, Fluorimetry, LaserTechniques.	30 Hours	1
IV	Electron Microscopy, Ion Chromatography, Nuclear Magnetic Resonance, TOC analyser.	30 Hours	1

References:

1. Willard H.H, MeritL.L, DeanJ.A. and SettleF.A., "Instrumental Methods of Analysis", 7thEd. CBP Publishers and Distributors, New Delhi1986

2. SkoogD.A.,WestD.M. and NiemanT.A, "PrinciplesofInstrumental

Analysis", 5th Ed.ThomsonAsion (P) Ltd. Singapore,2004

3. MendhamJ., DenneyR.C, BarnesJ.D and ThomasM., "Vogel"s Textbook of Quantitative Chemical analysis", 6th Ed. Pearson Education Ltd New Delhi 2002.

4. Sawyer C.N., McCarty P.L and ParkinG.F., "Chemistry for Environmental Engineers", 4th Edition, McGraw Hill, New Delhi,1994.

GE37021/GE36921ENVIRONMENTAL REMOTE SENSING

Course Objective:

1. To know the thermodynamics microbialsystem.
2. Learn about thetechnique.
3. How to examine microbial contamination ofwater.
4. Study about the different –phases of microbialgrowth.

Learning Outcome:

1. Introduction to the basic principles of environmentalchemistry.
2. Detailed knowledge of different parameter of water and wastewater.
3. Overview of remotesensing.
4. Know the aerobic and anaerobic process involved in the water and waste-water.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Historical Perspective, Principles of remote sensing, components of Remote Sensing,Energy source and electromagnetic radiation, Energy interaction, Spectral responsepattern of earth surface features	30 Hours	1
II	Classification of Remote Sensing Systems, Energy recording technology, Aerial photographs, Photographic systems – Across track and along track scanning,Multispectral remote sensing, Thermal remote sensing, Microwave remote sensing – Active and passive sensors, RADAR, LIDAR, Satellites and their sensors, Indian spaceprogramme - Research anddevelopment	30 Hours	1
III	Characteristics of Remote Sensing data, Photogrammetry – Satellite data analysis– Visual image interpretation, Digital image processing – Image rectification,enhancement, transformation, Classification, Data merging, RS – GIS Integration, Image processing software.	30 Hours	1

IV	GIS Concepts – Spatial and non spatial data, Vector and raster data structures, Data analysis, Database management – GIS software, Conservation of resources, Sustainableand use, Coastal zone management – Limitations	30 Hours	1

References:

1. Kiefer R.W, "Remote sensing and image interpretation", JohnWiley and sons, New York,2004.

2. KonechyG., "Geoinformation&Remote sensing, Photogrammetry andGeographical Information Systems", CRC press, 1st Edition,2002.

3. BurroughP.A, McDonnellR.A, "Principles of Geographic Information Systems" Oxford University Press, New York,2001.

4. Lintz.J, "Remote sensing of Environment", Addison WesleyPublishing Company, New Jersey,1998.

GE37022/GE36922 WATER POLLUTION

Course Objective:

1. Clean, safe & adequate freshwater is vital to the survival of all living organisms
2. Learn about the various parameters of wastewater
3. Detailed study about the physico-chemical methods involved in waste water treatment process.
4. To know about the biological treatment process.

Learning Outcome:

1. To know about the waste water treatment processes.
2. To understand the different physico-chemical parameter of waste water.
3. To develop knowledge about designing of different waste water treatment units.
4. To analyze the industrial waste water and learn its characteristics.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Beneficial uses of water and quality requirements, standards.Concepts of water and wastewater quality: physical, chemical and bacteriologicalexamination of water and wastewater. Water borne diseases and their control. **Wastewater characteristics** Temperature, pH, colour and odour, solids, nitrogen andphosphorus, chlorides, toxic metals and compounds, etc.Objectives of treatment: Water and wastewater treatment, unit operations and processesand flow sheets, latest codal limits.	30 Hours	1
II	Determination of settling velocity, efficiency of ideal sedimentation tank,short circuiting; different classes of settling; design of primary and secondary settling tanks; removal efficiency for discrete and flocculent settling.	30 Hours	1

	Coagulation Mechanisms ofcoagulation,coagulants and their reactions, coagulant aids;design of flocculators and clariflocculators.		
III	**Treatment Processes** Preliminary, primary, secondary and tertiary treatment processes.Primary Treatment: Screens, grit chamber and their design, sedimentation and chemicaltreatment to be given.Secondary Treatment: Theory of organic matter removal; activated sludge process,design of different units and modifications, extended aeration systems; trickling filters;aerated lagoons, wastestabilization ponds, oxidation ditches, R.B. C. etc.	30 Hours	1
IV	Design of low and high rate anaerobic digesters and septictank.Basic concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor,fluidized bed and expanded bed reactors and Disposal of wastewater on land and in water bodies. Introduction to Duckweed pond, vermiculture and root zone technologies and other emerging technologies for wastewater treatment.	30 Hours	1

References:

1. Metcalf and Eddy Inc.: “Wastewater Engineering”,TMH

2. Garg S.K., “Water Supply Engineering (Environmental Engineering vol. – I)”, KhannaPublication

3. Garg S.K.: “Sewage Disposal and Air Pollution Engineering Environmental Engineering Vol. – II)”, KhannaPublication

GE37023/GE36923RURAL ENVIRONMENTAL TECHNOLOGY

Course Objective:

1. Study about water, its characteristics and its constituentminerals.
2. Learn about the sedimentation principles of wastes inwater.
3. How to treat waste water: primary, secondary, tertiarytreatment.
4. Study about digestion ofsludge.

Learning Outcome:

1. Introduction to the water quality andassessment.
2. Detailed knowledge of settling laws of particulatecontamination.
3. To know the details of water treatmentprocess.
4. Know the anaerobic process to stabilizesludge.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**General** Concept of environment and scope of sanitation in rural areas. Magnitude of problems of rural water supply and sanitation. Population to be covered, difficulties. National policy. Water supply. Design population and demand loads.	30 Hours	1
II	Various approaches of planning of water supply schemes in rural areas.Development of proffered sources of water springs. Wells, infiltration wells, radial wells and infiltration galleries, collection of raw water from surface source. Specific problems in rural water supply and treatment.	30 Hours	1
III	Improved methods and compact systems of treatment of surface and ground waters for rural water supply, slow sand filter, chlorine diffusion cartridges. Pumps, pipes materials, appurtenances and improved devicesfor use in rural water.	30 Hours	1
IV	Planning of distribution system in rural areas. Treatment and Disposal of waste water. Various methods of collection and disposal of night soil. Simple waste water treatment units and systems in rural areas such as stabilization ponds, septictanks, latest	30 Hours	1

	developments in treatment of water.		

References:

1. Metcalf and Eddy Inc.: “Wastewater Engineering”TMH

2. Garg S.K.,“Water Supply Engineering (Environmental Engineering Vol. – I)”, KhannaPublication

3. Garg S.K.: “Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II)”, KhannaPublication

GE37024/GE36924 ENVIRONMENTAL IMPACT ASSESSMENT

Course Objective:

1. To learn the importance of environmental impact assessment in various engineering projects
2. To brief the various methodologies involved in environmental impact assessment
3. To identify the prediction tools for the assessment of different environmental impacts
4. To describe the concepts of environmental management system

Learning Outcome:

1. To analyze the environmental impacts of proposed projects
2. To predict the magnitude of an impact using mathematical tools
3. To propose proper mitigation measures to avoid environmental impacts
4. To summarize the EIA report with suitable environmental management plan

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Basic concept of EIA and Methodologies** Initial environmental Examination, Elements of EIA, factors affecting EIA Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters **E I A Methodologies** Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/Benefit Analysis.	30 Hours	1
II	**Impact of Developmental Activities and Land use** Introduction, Methodology for the assessment of soil and ground water, Delineation of study area, Identification of activities. Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.	30 Hours	1
III	**Prediction and Assessment of Impact** Quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the	30 Hours	1

	assessment of Impacts on surface water environment, Air pollution sources, generalized approach for assessment of Air pollution Impact.		
IV	**Environmental Audit & Environmental legislation** Objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, on-site activities, evaluation of Audit data and preparation of Audit report. Post Audit activities: The Environmental pollution Act, The water; Act, the Air (Prevention & Control of pollution Act.), Mota Act. Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.	30 Hours	1

References:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B.S. Publication, SultanBazar, Hyderabad.
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers
3. Environmental Science and Engineering, by Suresh K. Dhaneja – S.K. Katania& SonsPublication., New Delhi
4. Environmental Pollution and Control, by Dr. H.S. Bhatia – Galgotia Publication (P) Ltd, Delhi

GE37031/GE36931GROUND WATER MANAGEMENT

Course Objective:

1. To know source ofwater
2. Learn about the various parameters ofwater
3. Ground watermodeling.
4. To understand the mechanism of ground waterrecharge.

Learning Outcome:

1. To study about the different source of water and theiravailability.
2. To analyze the different parameter of water inlab.
3. To study quality aspect of ground water and surfacewater
4. To understand ground water managementtechnique.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Occurrence of ground water, Hydrological Cycle, Ground water contamination Sources and Mechanisms of Groundwater Pollution from Landfills and Waste Dumps.	30 Hours	1
II	Physical, Chemical and Biological Characteristics of Water. Standard methods ofdetermination of important physical and chemical parameters of water quality, eg.pH, turbidity, total Solids, alkalinity, hardness etc.	30 Hours	1
III	Well Hydraulics and Water Wells, Ground Water quality, Ground Water Modeling Techniques, Surface and Subsurface Investigations of Ground water	30 Hours	1
IV	Artificial discharge and Recharge of Ground Water, Ground Water Management Techniques.	30 Hours	1

References:

1. Sawyer C.N., MacCartyP.L. and Parkin G.F., "ChemistryforEnvironmentalEngineering and Science", Tata McGraw – Hill, Fifth edition, New Delhi

2. “Manual on water supply and Treatment”, CPHEEO,Ministryof UrbanDevelopment,Government of India, NewDelhi

3. G.M.; Masters Introduction to Environmental Engineering and Science, Prentice Hall ofIndia

GE37032/GE36932 GROUND WATER HYDROLOGY

Course Objective:

1. Hydrological cycle ofwater
2. Study the working and types ofwell
3. Study on ground waterpollution.
4. Design of rain waterharvesting.

Learning Outcome:

1. To study about the different source ofwater
2. Study about wellhydraulics.
3. Design of water treatmentprocess
4. Application of GIS in ground waterstudy.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Darcy"s law, General hydro-dynamic equations, flow- nets in isotropic medium, confined and unconfined aquifers,	30 Hours	1
II	Schwartz-Christoffel Transformation and its application for groundwater flow and Seepage problems. Multiple well system, partially wells, Image wells, Mutual interference of wells. Contamination of groundwater, control of Ground water	30 Hours	1
III	Control of ground water pollution.Storage and exploration of groundwater, drainage, construction and maintenance of wells, groundwater recharge and runoff, water quality, budgeting	30 Hours	1
IV	Stimulation of groundwater basin application of GIS and remote sensing for groundwater. Roof-top Rainwater Harvesting and Recharge.	30 Hours	1

References:

1. C.N Sawyer,.,P.L.MacCarty, and G.F Parkin,., Chemistry for

EnvironmentalEngineering and Science, Tata McGraw – Hill, Fifth edition, New Delhi

2. “Manual on water supply and Treatment”, CPHEEO, Ministry of UrbanDevelopment, Government of India, New Delhi

GE37033/GE36933DESIGN OF WATER SUPPLY SYSTEMS

Course Objective:

1. To know the different source ofwater
2. Learn about the various parameters ofwater
3. Detailed study about the methods involved in water treatmentprocess.
4. To know about the different types of pumping system and distributionsystem.

Learning Outcome:

1. To study about the different source of water and theiravailability.
2. Study about different method of populationforecasting.
3. Learn the hydraulic design of water treatmentprocess

Course Contents:

Module	CourseTopics	Total Hours	Credits
I	Estimation of water demand for various uses, factors affecting consumption and fluctuation of demand.	30 Hours	1
II	**Source of Water** Surface source - types, selection, storage reservoir – yield and capacity estimation by mass-curve method, concept of service and balancing reservoirs.	30 Hours	1
III	Water borne diseases and their control, water quality standard – potable and industrial.Water Purification-Sedimentation, Coagulation and Flocculation, Filtration, Disinfection, Miscellaneous Methods.	30 Hours	1
IV	Softening, Filtration, Disinfection, Desalination Dissolved Solids Removal, Adsorption and Ion Exchange, Electrolysis, Osmosis,Special Treatments, Pumping and Distribution Systems	30 Hours	1

References:

1. Hendricks D. “Water Treatment Unit Processes – Physical and Chemical” CRC Press, New York
2. Manualon “Sewerage and SewageTreatment”CPHEEO,Ministry ofUrbanDevelopment, Government of India, New Delhi,1999.
3. Metcalf & Eddy, INC, “Wastewater Engineering – Treatment and Reuse”,

FourthEdition, Tata McGraw-Hill Publishing Company Limited, New Delhi,2003.

4. Sawyer C.N, McCarty P.L and Parkin G.F, “Chemistry for Environmental Engineeringand Science”, 5th ed. TataMcGraw-Hill

GE37034/GE36934INDUSTRIAL WASTEWATER TREATMENT

Course Objective:

1. To know general characteristic and sources of industrial wastewater

2. Learn about the various parameters of industrial wastewater

3. To study about the methods involved in industrial water treatment process.

4. Which type of disposal adopted in industrial wastewater treatment process?

Learning Outcome:

1. To know about the waste water treatment processes.

2. To understand the different physico-chemical parameter of waste water.

3. To develop knowledge about designing of different waste water treatment units.

4. To analyze the industrial waste water and learn its characteristics

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Industrial scenario in India** Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater	30 Hours	1
II	Industrial wastewater monitoring and sampling, generation rates, characterization and variables, Toxicity of industrial effluents ,Typical Industrial Wastes Characteristics and Treatment Planning of Sugar Industry, Distillery, Tannery, Electroplating Industry, PetroleumIndustry.	30 Hours	1
III	Pesticide and Fertilizer Industry, Pharmaceutical Industry Textile Industry, Pulp and Paper Industry,Chlor- Alkali Industry, Soap and Detergent Industry, Atomic Power Plants, Dairy, Steel, Thermal PowerPlants.	30 Hours	1

IV	General Standards for Disposal of Effluents, Concept of Common Effluent Treatment Plant.Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems -	30 Hours	1

References:

1. Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw Hill, New Delhi,2003

2. Jaya P. , Reddy R. , "hydrology" LaxmiPublication

3. Sawyer C.N, McCarty P.L and Parkin G.F, "Chemistry for Environmental Engineering and Science", 5th ed. TataMcGraw-Hill

4. GargS.K,." Water Supply EngineeringVol.1", KhannaPublishers,NewDelhi