ADVANCED WATER TREATMENT TECHNOLOGY			
Course Code	**MCEE201**	CIE Marks	50
Teaching Hours/Week(L:P:SDA)	03:02:00	SEE Marks	50
Total Hours of Pedagogy	40hoursTheory+10-12Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives:

- Analysis of physical and chemical characteristics of water treatment technology
- Understand and design of different unit operations and unit processes in water treatment technology

MODULE-1

Introduction–Objectives and necessity for Treatment of water. Sources of water and their characteristics. Micro-organisms in natural water purification system. Drinking water quality requirements as per BIS & WHO guidelines. Sources of Water Pollution, Diseases and Control. Public Health Significance.
FlowDiagramonoverallwatersupplyProjectforvillages&cities.Unitdiagramsandflowcharts
On Water Treatment System. Suitability of IntakeStructuresand types.

(8hrs)

Teaching-Learning Process	Chalk and Talk, Power Point Presentation and Video Lecture.

MODULE-2

TreatmentOperationsandEngineeringSystemsforWater Purification – Typical treatment for ground water containing Hardness and Turbid surface water contaminated with organisms. Water Aeration process, Importance and limitations. Gas Transfer two film model: Water in Air system and Air in water system. Estimation of Solubility of Air in water with Henry's Law. Significance of DO in Water Principles of Sedimentation Process and Stokeslaw inDetail. SeparationofSolids. DesignCriteriaanddesignofSedimentationtank. Type-I and Type-II Settling pattern in the removal of Discrete particles.

(8hrs)

Teaching-Learning Process	Chalk and Talk, Power Point Presentation and Video Lecture

MODULE-3

Coagulation and Flocculation Process – Theory of Coagulation and Principle. Types of Coagulants used and their characteristics, Chemical reaction with water. Alkalinity Coagulation relationship.
CoagulantAids,Chemicalfeedingdevices.DeterminationofOptimumCoagulantDosage.
Numericaldesignproblemsonestimationof Coagulants.

(8hrs)

Teaching-Learning Process	Chalk and Talk, Power Point Presentation and Video Lecture.

MODULE-4

WaterTreatmentbyFiltrationProcess –TheoryofFiltrationand basicPrinciples. Classificationof Filters used in treatment of water. Filterswashing Technique/back wash. Operational troubles and trouble shooting. Design criteria used and Design of Slow and Rapid Sand Filters required for water treatment plant. (8hrs)	
Teaching-Learning Process	Chalk and Talk, Power Point Presentation and Video Lecture.
MODULE5	
Water Disinfection Process – Disinfection methodologies and their suitability. Theory of Disinfection and characteristics of good disinfectant. Forms of Chlorination, Chemical reactions, Break point Chlorination. Measurement of Chlorine Demand and residual Chlorine. Estimation of quantity of Chlorine and Bleaching powder required for treatment of water. **WaterSoftening**-Hardnessremovaltechniques,numericalproblemsondeterminationofHardness in water sample and Studies on effects of hardness. Fluoridation and Defluoridation techniques in affected areas. (8hrs)	
Teaching-Learning Process	Chalk and Talk, Power Point Presentation and Video Lecture

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:
Books

1. Fair, G.M., Geyer J.C and Okun, (1969) "Water and Waste water Engineering" Vol II, John
Wiley Publications.
2. Weber W.J., (1975) "Physico - Chemical Processes for Water Quality Control".
3. Peavy, H.S., Rowe and Tchobonoglous,G., (1985), "Environmental Engineering", McGraw Hill.
4. ViessmanJr, Hammer J. M, Perez, E.M, and Chadik, P. A, Water Supply and Pollution Control, PHI Learning, New Delhi, 2009.
5. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, Environmental Engineering, McGraw Hill., 1984

FOR LABORATORY:

1. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GoI,New Delhi, 1999.

2. Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development,GoI, New Delhi,

3. Software Package Manual on BRANCH, LOOP, SEWER – UNDP/UNEP.

4. WATPLANT and QUALOOP Softwares. – CPHEEO – Manual.

5. Relevant Software Manuals– USEPA

6. Wark.K, Warner G.F. and Davis W.T – Air Pollution its origin and control, Addison-Wesley,

7. Thomann R.V and Mueller J.A –. Principles of surface water quality modeling and control, Harper & Row Publishers,

8. Sincerio A.P.&Sincerio G.A., Environmental Engineering – A Design Approach Prentice Hall of India.

9. "Standard Methods for the Examination of Water and Wastewater", 21th Edition, American

10. Public Health Association, Washington. D.C . 2005

WeblinksandVideoLectures(e-Resources):

SoftwarePackageManualonBRANCH,LOOP,SEWER –UNDP/UNEP. WATPLANT and

QUALOOP Softwares. – CPHEEO – Manual.

RelevantSoftwareManuals–USEPA

ActivityBasedLearning(SuggestedActivitiesinClass)/PracticalBasedlearning

Visit tonearbytreatment plantanddesignoftreatment plant fordifferent MLD

Courseoutcome(CourseSkillSet)

At the end ofthe coursethestudentwillbeable to:

Sl.No.	Description	Blooms Level
CO1	Objectives and importance of water treatmentprocessesandtoassess the waterqualityparameters	L1
CO2	Understandtheprinciplesandoperationsofaerationandsedimentation processofwatertreatmentsystems	L2
CO3	Understandthetheoryandprincipleofcoagulationand estimatethe coagulant dosage	L2
CO4	Evaluatetheperformanceoffilterunitalongwithfilterbackwashing	L3
CO5	Tolearntthedisinfection,softening,fluoridationanddefluoridation technique	L2

MappingofCOSandPOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	2	1	2	3	1	1	1	1	2
CO2	3	2	3	1	-	2	2	1	1	-	-	1
CO3	3	2	3	1	-	2	2	1	1	-	-	1
CO4	3	1	-	2	-	2	3	1	3	3	1	1
CO5	3	2	3	1	-	2	2	1	1	-	-	1

0--NoAssociation.1---LowAssociation2---ModerateAssociation3---HighAssociation

ADVANCED WASTEWATER TREATMENT TECHNOLOGY			
Course Code	**MCEE202**	CIEMarks	50
TeachingHours/Week (L:P:SDA)	02:02:00	SEE Marks	50
TotalHoursofPedagogy	40 hoursTheory	Total Marks	100
Credits	03	Exam Hours	03

Courseobjectives:

- Toprovideabasicdescriptionandunderstandingoftheprincipalunit processesused in the treatment of wastewater.
- Thiswillincludecoverageofthe scientific basisofeachunit process, aswellasthe conventional approach to their engineering design.
- Inthe areaofwastewatertreatment thecoursewillprovideanunderstandingofthe kinetictheoryofbiologicalgrowthandapply ittotypicalaerobicprocesses,and an appreciationofthepurposeand practiceofsludgetreatment.

MODULE-1

Domestic Wastewater characteristics, flow fluctuations, types of reactors and mass balance approach. Wastewater Treatment: Flow Diagrams and Hydraulic Profile. DesignofSewers: Design of sanitary sewer; partial flow in sewers, economics of sewer design. Kinetics of biologicalwastewatertreatment systems– monads,biokineticconstants,theirdetermination and their applications, batch and continuous system.

(8hrs)

Teaching - Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.

MODULE-2

Designprinciplesanddesignofunit operationsystems -screen,Skimming(Floatation)tank equalization basin, grit chamber, and primary settling tank.

(8hrs)

Teaching-Learning Process	. ChalkandTalk,PowerPointPresentationandVideo Lecture.

MODULE-3

Design Criteria and design of Biological processes suspended and attached growth systems, conventional activated sludge process and it smodifications. Design principles of trickling filter, bio-towers and rotating biological

(8hrs)

Teaching-Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.

MODULE 4

Advanced Wastewater Treatment: Need and technologies used. **Nitrification and Denitrification** Processes, colour & COD removal of wastewater by Ozonation, & Fentons Oxidatition, Application of Electrooxidation processes for Effluent Treatment Phosphorous removal. Wastewater disinfection (8hrs)	
Teaching-	
Learning Process	Chalkand Talk, PowerPoint Presentation and Video Lecture.

MODULE5	
Biological Sludge separation, conditioning and volume reduction Design of Sludge Processing units – secondary settling tank, g thickeners and digesters– aerobic and anaerobic.Wastewatertreatmentsystemsforsmallcommunities–septictanks,soakpits, two-pitlatrines, eco-toilet. (8hrs)	
Teaching-Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks**

to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

3. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
4. The question paper will have ten full questions carrying equal marks.
5. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
6. Each full question will have a sub-question covering all the topics under a module.
7. The students will have to answer five full questions, selecting one full question from each module

WeblinksandVideoLectures(e-Resources):

- **https://onlinecourses.nptel.ac.in/noc22_ce27/preview**
- **https://archive.nptel.ac.in/content/storage2/courses/105104102/Lecture%207.htm**
- **https://nptel.ac.in/courses/105104102**
- **https://onlinecourses.nptel.ac.in/noc22_ce27/preview**
- **https://nptel.ac.in/courses/105106119**

ActivityBasedLearning(SuggestedActivitiesinClass)/PracticalBasedlearning activities

Visit to nearby wastewater treatment plant and design for other MLD.

Courseoutcome(CourseSkillSet)

At theend ofthecoursethestudentwillbeable to:

Sl. No.	Description	Blooms Level
CO1	Explain the need for wastewater treatment, categorize the wastewaterbased on characteristics, illustrate reactor types in wastewater treatment; explainthebasicconceptofmassbalance;planthetreatmentscheme throughflowdiagram,sewerdesignand hydraulicprofile.	L1
CO2	Understand and apply the design principles and criteria in designing units suchasscreen,gritchamber,primarysettlingtank.Establishbiokinetic constantsintheengineeringdesignofwastewatertreatmentprocesses.	L2
CO3	Describethedesigncriteriaanddesignthesuspendedandattachedgrowth biologicalwastewatertreatmentsystemslikeactivatedsludgeprocess, trickling filter,RBC,Biotowers.	L3
CO4	Emphasizetheneedforsludgeseparation,thickeningandvolumereduction.Designthefacilitiesfor biologicalsludgehandlingand treatment ofbiological sludge.Applicationsofadvance wastewater treatment.	L3
CO5	Illustratewastewatertreatmentsystemsforruralareas.Explainthe applicabilityofnaturalsystemsfortreatmentofwastewater.	L1

MappingofCOSandPOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	3	3	3	2	2	3	2
CO2	3	3	3	2	3	2	3	2	2	3	2	1
CO3	3	3	3	2	3	2	1	2	2	2	1	3
CO4	3	3	2	2	3	2	2	2	3	3	2	2
CO5	2	2	1	1	2	3	3	3	2	2	2	1

0--NoAssociation.1---LowAssociation2---ModerateAssociation3---HighAssociation

SOLID WASTE ENGINEERING AND MANAGEMENT			
CourseCode	**MCEE203**	CIEMarks	50
TeachingHours/Week(L:P:SDA)	02:00:02	SEEMarks	50
TotalHoursofPedagogy	40hours	TotalMarks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- Thestudent willhaveathoroughknowledgeofkeyfunctionalelementsinmunicipalsolid waste management including waste minimization concepts.
- Designingofengineeredlandfillsitesforthedisposalofsolid wastes.

Module-1

I**ntroduction :**Sources and engineering classification, functional elements of solid waste management , characterization (numerical); Objectives, principles, system–Regulatory aspects of solid waste management, major problems. Environmental implications of open dumping, Construction debris–management & handling, E-WasteManagement, Ragpickers and theirrole.

(8hrs)

Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Module-2

Waste Generation: Rate of generation (numerical), frequency, storage and refuse collection, physical and chemical composition, quantity of waste, engineering properties of waste, prediction, modeling concepts.

Collection, Segregation and Transport:Handling and segregationofwastesatsource,Collection (Haul and stationary- numericals) and storage of municipal solid wastes, collection equipment, transfer stations, collection route optimization and economics, regional concepts. System dynamics.

(8hrs)

Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Module-3

WasteMinimization: 4R:reduce,recover,recycleandreuse, casestudy, guidelines

Treatment Methods : Refuse processing technologies. Mechanical and thermal volume reduction. Biological and chemical techniques for energy and other resource recovery: composting, vermicomposting. Incineration of solid wastes.

(8hrs)

Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Module-4

Disposal Methods: Impacts of open dumping, site investigation and selection, sanitary land filling- Types, geotechnical considerations, design criteria and design, Liners - earthen, geo membrane, geo synthetics and geo textiles.

Operational aspects of MSW Landfills : Daily cover, leachate disposal, Ground Water monitoring, leachate and gas collection systems–Design, leachate treatment. Landfill Final Cap Design and Water Balance, Modelling (HELP–HydraulicEvaluationofLandfillPerformance), post-closure environmental monitoring ;landfill remediation.

(8hrs)

Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Module-5

Recent Developments in Solid Wastes Reuse and Disposal :Power Generation, Blending with construction materials and Best Management Practices (BMP). Community based waste management, Waste as a Resource concept, Public private partnership (PPP)Role of various organizations in Solid Waste Management :Governmental, Non - Governmental,Citizen Forums. (8hrs)

Teaching-LearningProcess	Chalkandtalk,powerpointpresentationandvideolecture.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks**

to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

SuggestedLearningResources:

Books

- Tchobanoglous G., Theissen H., andEliassen R., "Solid Waste Engineering Principles and Management Issues", McGraw Hill, New York. Pavoni J.L., "Handbook of Solid Waste Disposal".
- Peavy,RoweandTchobanoglous,"EnvironmentalEngineering",McGrawHill
- CPHEEOManualonSolidWasteManagement.WHOManualonSolidWasteManagement.
- VesilandA.,"SolidWasteEngineering",ThompsonBooks.
- FlintoffF.,(1976),"ManagementofSolidWastesinDevelopingCountries",WHO4.RegionalPublications, SouthEastAsia,NewDelhi

WeblinksandVideoLectures(e-Resources):

- https://www.youtube.com/watch?v=k0ktJRoRcOA
- https://youtu.be/qX516jcwCKE
- https://youtu.be/YujIiRB_bCE
- https://youtu.be/CME8ym5WbcY
- https://youtu.be/o_8a-zVUO1Y
- https://youtu.be/bhHi2GUh12E

SkillDevelopmentActivitiesSuggested

- Fieldvisittothenearbydisposalsiteandquantisationofsolidwastes/day

Courseoutcome(CourseSkill Set)
At the end of the course the student will be able to :

Sl.No.	Description	BloomsLevel
CO1	Identify improperpracticesofsolidwaste disposalandtheirenvironmental implications.Knowthebasicengineeringprinciplesofsolidwaste management	L1
CO2	Describe the need for economicsin collection and transportation of solid wasteandclearlydiscussvarioustypesofcollectionsystemsandanalyse systemdynamics	L3
CO3	Understandthemanagementconcepts,define4Rapproach,applyPPP modelandcommunityinvolvementforeffectivemanagementofsolid waste	L2
CO4	Developaconciseideaonvariousconventionalandadvancedtreatment optionsforsolidwaste	L2L3
CO5	Conceive the design aspects of engineered disposal options and apply the gained knowledge	

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**-**	**1**	**-**	**1**	**3**	**3**	**2**	**1**	**2**	**3**	**3**
CO2	**2**	**1**	**3**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**1**	**1**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**2**
CO4	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**1**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**2**

ATMOSPHERIC AIR POLLUTION AND CONTROL			
Course Code	**MCEE204**	CIEMarks	50
TeachingHours/Week (L:P:SDA)	02:00:02	SEE Marks	50
TotalHoursofPedagogy	40 hours	Total Marks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- The course covers the air pollution sources, classification, effects, and measurement ofair pollutants, standards, importance of meteorology in air pollutant dispersion, fate and transportofairpollutantsusingvariousmathematicaltools,aswellasairandnoise pollutioncontroltechnologiesand regulations.

Module-1

Introduction: Definition of Air Pollution, sources, characterization and classification of atmospheric pollutants, air pollution episodes. Effects of air **pollutants** on human health, vegetation, animalsand materialsand monuments. Compositionand structureofthe atmosphere; Visibility and other related atmospheric characteristics.

(8hrs)

Teaching-Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.

Module-2

Meteorology: Wind circulation, solar radiation, lapse rates, atmospheric stability conditions, windvelocityprofile,MaximumMixingDepth,TemperatureInversions,plumebehaviour,Wind rose diagram, general characteristics of stack emissions, heat island effect.

Monitoring of particulate matter: Respirable, non-respirable and nano - particulate matter. Monitoring of gaseous pollutants – CO, CO_2, Hydrocarbons, $SO_X$and NO_X, photochemical oxidants. Monitoring equipment and sampling devices – stack sampling (Isokinetic sampling),air samplers, gas exhaustanalyzer. Air Pollution Index.

(8hrs)

Teaching-Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.

Module-3

Pollutants' dispersion models: Point, line and areal sources models. Box model, Gaussian plume dispersion model – for point source (with and without reflection), Gaussian dispersion coefficient, Determination of ground level concentrations. Infinite line source Gaussian model. plume rise and effective stack height calculations.

(8hrs)

Teaching-Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.

Module-4

Air Pollution Control Equipment: Mechanisms, Control equipment for particulate matter – gravity settling chambers, centrifugal collectors, wet collectors, scrubbers, fabric filters, electrostatic precipitator (ESP) - Design principles and criteria with design **Control Equipment for gaseous pollutants** – adsorption, absorption, condensation and combustion. Design principles. (8hrs)	
Teaching-Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.
Module-5	
IndoorAirPollution: Sources,indooraircontaminants,effectsandcontrol.airchangesper hour (ACH), IAQ Standards **Noise**-sources,measurements,effectsandoccupationalhazards.Standards,Noisemapping, Noiseattenuationequationsandmethods,predictionequations,controlmeasures,Legalaspects ofnoise. (8hrs)	
Teaching-Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

SuggestedLearningResources:

Books

- Crawford, M.,(1980),"AirPollutionControlTheory"- TATAMcGraw Hill.
- HowardS.Peavy,DonaldR.RoweandGeorgeTechnobanoglous.,(2017) "EnvironmentalEngineering"–McGrawHillInternationalPublications.
- Stern,A.C.,AirPollution,VolI,II,III.
- Stern,A.C.,(1977),"AirPollution:TheEffectsofAirPollution" –3rd-Edition, Academic Press
- C.SRao.,(2006),"Environmental pollution control engineering"-Newageinternational publishers.
- M.NRaoandH.V.NRao.,(1999),"AirPollution"-TataMcGraw-HillPublishingCompany Limited, New Delhi.
- Wark,K.,Warner,C.F.,andDavis,W.T.,(1998),"AirPollution"-

Web links and Video Lectures (e-Resources):

- **https://www.digimat.in/nptel/courses/video/105104099/L01.html**
- **https://www.digimat.in/nptel/courses/video/105104099/L02.html**
- **https://www.digimat.in/nptel/courses/video/105104099/L03.html.**

Skill Development Activities Suggested

- **Visit to nearby industry having air pollution control equipments.**

Hands on training on air pollution monitoring and desire software's.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO 1	Understand the importance of composition and structure of atmosphere, sources, classification, effectsofair pollutants, and measurementofairpollutants,airpollutionstandardsand controlregulations.	L2,L4
CO 2	Understand the basic conceptsofvarious meteorological factors which influence the dispersion of air pollutants and to create windrosediagram,GainKnowledgeaboutthemonitoringof particulatematter.	L2,L3 ,L4
CO 3	Predictionofdispersionofairpollutantsusingdifferentmodels andtoevaluatetheplumeriseusingvariousmodel equations and get a fair knowledge on stack sampling.	L2, L5, L 6
CO 4	Understandandanalyzethebasicmechanismsinvolved,workingprinciplesanddesignaspectsofvariousairpollution controllingequipment'sthroughdemonstration.	L2, L4, L 6

CO 5	UnderstandtheconceptofIndoorAirPollutionandNoise Sourceand Control.	L2,L4

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	3	3	2	2	2	1	2
CO2	3	3	2	2	1	2	3	3	2	2	1	2
CO3	2	2	3	3	3	2	3	2	2	1	2	2
CO4	3	2	3	3	3	2	3	2	1	2	2	1
CO5	3	3	2	3	3	2	3	2	2	3	2	2

0--NoAssociation.1---LowAssociation2---ModerateAssociation3---HighAssociation

OCCUPATIONALSAFETYANDHEALTH(OSHA)			
CourseCode	**MCEE215A**	CIEMarks	50
TeachingHours/Week(L:P:SDA)	02:00:02	SEEMarks	50
TotalHoursofPedagogy	40 hours	TotalMarks	100
Credits	3	ExamHours	03

CourseLearningobjectives:

- Thiscourseenablesstudent tolearnthebasicprinciplesofsafety,OSHact andthe national policy.
- It givesknowledgeoncause-effect relationshipsofaccidentsatworkplaces,need for economics&ergonomics,hazardidentificationandcontrolaspects,firepreventionand control.
- Workplacehealthrelatedissuesarecovered.

Module-1

Introduction – concept and scope of occupational safety and environmental health, basic requirements for healthy environment and environmental quality, human exposure and impact of environment factors on health.

OccupationalSafety andHealth OccupationalHealthand SafetyAdministration- Lawsgoverning OSHAandRighttoknow,NationalsafetyLaw,typesofdiseasesandtheirspread,Health Emergency.

(8hrs)

Teaching-LearningProcess	Chalkandtalk,powerpointpresentationandvideolecture.

Module-2

Ergonomicsatwork place-Preventingergonomichazards,Ergonomictaskanalysis,Ergonomic standards, and Ergonomic programs.

Occupationalhazardandcontrol–Hazardanalysis,Humanerrorandfaulttreeanalysis, Emergency response, Principles of Safety.

(8hrs)

Teaching-LearningProcess	Chalkandtalk,powerpointpresentationandvideolecture.

Module-3

Firepreventionandprotection–firetriangle,firedevelopmentanditsseverity,effectof enclosures, early detection of fire, classification of fire and fire extinguishers.
Electricalsafety,Productsafety-safehandlingofchemicals,safetyproceduresofnuclear installations.

(8hrs)

Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Module-4

Accidents–causation, investigstion, methodsofacquiringaccident facts,supervisoryrole inaccident investigation.
Personalprotectiveequipments–typesandadvantages,effectsofexposureandtreatmentfor engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability.

(8hrs)

Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Module-5

Occupational health and safety considerations.
Water and wastewater treatment plants, handling of chemicals and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors.

(8hrs)

Teaching-LearningProcess	Chalk and talk, powerpoint presentation and video lecture.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

SuggestedLearningResources:

Books

- GoetschD.L.,(1999),"OccupationalSafetyandHealthforTechnologists,
- EngineersandManagers",PrenticeHall.
- CollingD.A.,(1990),"IndustrialSafetyManagementandTechnology",PrenticeHall,NewDelhi.
- Della D.E.,andGiustina,(1996),"SafetyandEnvironmentalManagement",Van4.NostrandReinhold InternationalThomsonPublishingInc.BiomedicalWaste(HandlingandManagement)Rules
- Trevethick, R.A., ((1973), "Environmental and Industrial Health Hazards"- William 10. HeinemannMedical Books Ltd., London

WeblinksandVideoLectures(e-Resources):

- .**https://nptel.ac.in/courses/114106017**
- **https://youtu.be/8nbOI-0U9Co**
- **https://youtu.be/Be9inw8xlw8**
- **https://youtu.be/n7oUOUCIblg**

SkillDevelopmentActivitiesSuggested

- VisittonearbyIndustryandacquireknowledgeonsafetymeasures

Courseoutcome(CourseSkill Set)

At the end of the course the student will be able to :

Sl.No.	Description	BloomsLevel
CO1	Gainknowledgeonsafetyandhealthprinciples,OSHAandRighttoknow, National safety Law, types of diseases and their spread, Health Emergency.	L1
CO2	Developtheskills ofunderstandingtheergonomicsandaddress specificproblems with appropriate strategies. Identify the problems related to the ergonomics and suggest remedial measures.	L2
CO3	Performaccidentinvestigationandreportpreparation,describetheneedforthe productsafetyandacquireknowledgeonvariousaspectsoffire–types, prevention and protection.	L2
CO4	Performbasic accidentinvestigationandreportpreparation.conceptof Protective equipment'sandenvironmentalmanagementplan.	L2
CO5	DiscussHealthandSafetyConsiderationsatdifferentworkplaceswitha thoroughunderstandingofPPEs.Listdifferenttypesofdiseasesandrecommend healthemergencymechanism.Gain knowledge through some bestmanagement practices.	L1

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	3	2	3	2	2	2	3	2	2
CO2	3	2	1	2	3	2	3	3	2	2	3	1
CO3	3	2	1	3	3	2	3	2	2	2	3	2
CO4	3	2	2	3	3	2	3	2	2	3	2	1
CO5	2	2	3	2	3	2	3	2	2	3	2	3

0--NoAssociation.1---LowAssociation2---ModerateAssociation3---HighAssociation

APPLIED ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY			
CourseCode	**MCEE215B**	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
TotalHoursof Pedagogy	40 hours of teaching	TotalMarks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- The chemistryprovides anindepthknowledgeofbasicsofchemistry,varietyofreactions andintroduces equilibrium chemistry and lays foundation of electrochemistry, colloidal andsurface chemistry.
- Itencompasseswaterandwastewateranalyticalandinstrumentalmethodsofanalysis.
- ItprovidesthebasicsofmicrobiologicalaspectsrelatedtotheEnvironment

Module-1

ImportanceofEnvironmental Chemistry asappliedtotheEnvironmental Engineering,typesofreactions,reversibleandirreversiblereaction,redoxreactions,andreactionkinetics. Modesofexpressionformolarity,normality,molality,etc.,Electrochemistryanditsapplications.Physical and equilibriumChemistry–fundamentalsandapplications.pH– Principle,Measurement,NumericalExamples,BuffersandBufferindex

(8hrs)

Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Module-2

ColloidalChemistry:Colloids–Types,propertiesandenvironmentalsignificance.Colloidaldispersions in water, air and emulsions. Theory of colloids – double layer theory, zeta potential,destabilization of colloids (Schulze – Hardy rule) as applied to coagulation process. Absorption andadsorptionprocess,adsorptionisotherms.

(8hrs)

Teaching - Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Module-3

Instrumental methods of analysis: Lambert's and Beer's law. Colorimetry – estimation of iron andmanganese in water samples. Methods of determining the trace organic and inorganic contaminantsusingemissionandabsorptiontechnique.

(8hrs)

Teaching-LearningProcess	Chalkandtalk,powerpointpresentationandvideolecture.

Module-4

Water&wastewateranalysis:Fluoridation,deflouridation,chlorination,BOD,DO,typesandmeasurementofBOD,rateofBOD&theoreticaloxygenremoval,COD-determination&itsapplicationinwastewatertreatment.

(8hrs)

Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Module-5
Microbiology -Microorganismsofimportanceinair,waterandsoil environmentPrinciplesandapplicationsofmicroscopy,microscopicflora andfauna ofimportance. Metabolism and metabolic pathways, Bioconcentration, Biomagnification and Bioaccumulation.Bacteria– Morphology,typicalgrowthcurveandgenerationtime,MeasurementTechniques–APC, MPN(ProbabilityandThomasmethods),MFT.Monod'sequationand itsapplications. Algae - orphology, classification and their importance. Fungi - Protozoa - morphology, classificationandtheirimportance.Enzymes-classification,kinetics–Michaelis-Menten equation,factorsinfluencingenzymereaction. Virology-Types,characteristicsandenumerationmethodology. (8hrs)

Teaching-Learning Process	Chalkand talk,powerpointpresentationandvideolecture.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

SuggestedLearningResources:
Books

1. PelczarM.J,ChanECS,Krieg,NR"TextbookofMicrobiology"5theditionTataMcGraw HillPublishingCo.Ltd.,NewDelhi
2. SawyerC.N.andMcCarty,P.L.,,"ChemistryforEnvironmentalEngineeringandScience", 5thEdition, TataMcGrawHillPublishingCo. Ltd.,NewDelhi
3. GaudyandGaudy,"MicrobiologyforEnvironmentalScientistsandEngineers",McGrawHill.
4. APHA,"StandardMethods forExaminationofWaterandWastewater";21stEdition
5. StumnandMorgan,"AquaticChemistry",JohnWilley&Sons

WeblinksandVideoLectures(e-Resources):

- https://nptel.ac.in/courses

SkillDevelopmentActivitiesSuggested

- AdvancedinstrumentsdemonstrationandTraining.

	Courseoutcome(CourseSkillSet) Attheendofthecoursethestudentwillbeableto:	
Sl.No.	**Description**	**BloomsLevel**
CO1	Identify types of chemical reactions and evaluate the feasibility of givenreaction based on thermodynamics properties. List and describe types ofelectrodesandelectrodepotential.Measure pH,emfandotherrelated parameters.	L1
CO2	Classify colloids, discuss their properties and their environmental significance.Applytheunderstandingoftheunderlyingconceptsofchemistryint he designofwaterandwastewatertreatmentsystems.	L2
CO3	Applytheknowledgeofinstrumentalanalyticaltechniquesformeasuringdiffere nt types of environmental pollutants. Discuss the need for microbiologyandidentifydifferentfloraandfaunaofimportanceinwater,airands oilmedia.	L3
CO4	Applytheunderstandingoftheunderlyingconceptsofchemistryinthe designofwaterandwastewatertreatmentsystems.	L1
CO5	Applytheknowledgeofusingmicrobesinpollutioncontrolactivities. Reviewemergingmicrobialcontaminantsand Formulateenzymaticrelationship susingkinetics.	L1

MappingofCOSandPOs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**2**	**2**	**-**	**2**	**3**	**1**	**3**	**-**	**1**	**1**
CO2	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO3	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**1**
CO4	**3**	**1**	**-**	**3**	**-**	**2**	**3**	**1**	**3**	**3**	**3**	**1**
CO5	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

0-NoAssociation.1---LowAssociation2---ModerateAssociation3---HighAssociation

RENEWABLE ENERGY AND ALTERNATIVE FUELS			
Course Code	**MCEE215C**	CIEMarks	50
TeachingHours/Week (L:P:SDA)	02:00:02	SEE Marks	50
TotalHours ofPedagogy	40 hours	Total Marks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- To createawarenessinstudentsfamiliaraboutimportanceofalternative fuels.
- Toteachcombustionandemissioncharacteristicsofvariousgaseousand liquidalternative flues.
- Toteachadaptabilityofenginestoalternativefuels.

Module-1

Introduction to energy and resources – Renewable energy sources - Availability of solar energy – Sun-earth relationships - - Solar radiation measurement – Flat plate collectors – Solar waterheating systems – Evacuated Tubular Concentrators - Solar air heating systems and applications – Conceptsonsolardrying,cooking,desalination,solarpondsandsolarcooling- Passiveheating andcoolingofbuildings–BasicsofsolarconcentratorsandtypesSolarthermalpower generation.

(8hrs)

Teaching-Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.

Module-2

Biomass to energy conversion processes – Anaerobic digestion, process parameters, biogas composition, digester types, high rate anaerobic conversion systems – Alcohol from biomass – Biodiesel: preparation, characteristicsand application - Biomasscombustionand powergeneration – Briquetting – Gasification: Process, types of gasifiers, applications – Waste to energy technologies.

(8hrs)

Teaching-Learning Process	ChalkandTalk,PowerPointPresentationandVideo Lecture.

Module-3

Power in the wind - Types of wind mills – WEG components, Power curves and energy estimation– Indian wind potential. Small Hydro Power: Types, site identification, head and flow measurement, discharge curve, estimation of power potential and system components. Technologies for harnessing renewable energy sources like geothermal, wave, tidal and ocean thermal energy.

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture

Module-4

Fossil fuels and their availability - Potential alternative liquid and gaseous fuels - Merits and

demerits of various alternative fuels - Engine requirement. Methods of production - Properties - Blends of gasoline and alcohol - Performance in SI engines – Adaptability - Combustion and emission characteristics - Performance in CI engines - Emission characteristics - Properties of alcohol esters. Production and properties of CNG, LPG, hydrogengas, biogas and producer gas - Performance and Storage, distribution and safety aspects**.**

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture.

Module-5

Various vegetables oils - Properties - Esterification - Performance and emission characteristics - Bio-diesel: Feed stock, characteristics, preparation (lab and commercial), storage, applications, environmental impacts, economics, policy.

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

SuggestedLearning Resources:

Books

- **Frank Kreith and D.YogiGoswami (2007), Handbook of Energy Efficiency and Renewable Energy, CRC Press.**
- **John Twidell and Tony Weir (2006), Renewable Energy Resources, 2nd Edition, Taylor & Francis, USA.**
- **John A. Duffie and William A. Beckman (2006),**
- **Solar Engineering of Thermal Process, 3rd Edition, John Wiley & Sons.**
- **Gilbert M. Masters (2004), Renewable and Efficient Electric Power Systems, Wiley Interscience.**
- **Osamu Hirao and Richard Pefley (1988), Present and Future Automotive Fuels,**

Wiley Interscience Publication, New York

- **Alcohols and Motor Fuels: Progress in Technology - Series No. 19 - SAE Publication USA C**

WeblinksandVideoLectures(e-Resources):

- https://www2.tulane.edu/~sanelson/eens1110/energy.htm
- https://www.eia.gov/energyexplained/biomass/
- https://www.iberdrola.com/sustainability/renewables-energy-wind-power
- https://www.hydropower.org/iha/discover-types-of-hydropower
- https://www.britannica.com/science/fossil-fuel

SkillDevelopmentActivities Suggested

Visit to the nearby renewable energy plants

Courseoutcome(CourseSkill Set)

At the end of the course the student will be able to :

Sl.No.	Description	Blooms Level
CO1	Learnneed foralternative fuels	L1
CO2	Learnsourcesofvariousalternativeflues	L1,L2
CO3	Anunderstandinglimitationoffossilfuelsandcombustion characteristicsfuels	L2

MappingofCOSand POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	2	1	1	1	1	1	1	1
CO2	2	1	1	1	1	1	1	2	1	1	1	1
CO3	2	2	2	2	1	1	1	1	1	1	1	1

0--NoAssociation.1---LowAssociation2---ModerateAssociation3---HighAssociation

CLIMATE CHANGE AND GLOBAL WARMING			
CourseCode	**MCEE216A**	CIEMarks	50
TeachingHours/Week(L:P:SDA)	02:00:02	SEEMarks	50
TotalHoursofPedagogy	40hoursofteaching	TotalMarks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- ExplainEarth's naturalgreenhouseeffectandalternateEnergysources
- Identifynaturaland humancreated sourcesofgreenhousegases.
- UnderstandthattheEarth'ssystems,Policyandlawstorestrictclimatechange
- Explainwhyclimatechangeisaglobaloccurrence, not alocalone.

Module-1

Globalwarming: EnergyIssuesandClimateChange,WarmingEarth-Heatandprinciplesof Thermodynamics,AlternateEnergySources.

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture.

Module-2

Greenhousegases:Green-HouseEffect asaNaturalPhenomenon, GreenHouseGasesGHGs)and theirEmissionSourcesQuantificationofCO_2Emission, GlobalWarmingPotential(GWP)ofGHGs.

(8hrs)

Teaching-LearningProcess	Chalk and Talk, PowerPoint Presentation and Video Lecture.

Module-3

climate change and its impact: Impacts of climate change:Ozone layer depletion and its control, Global and India, Temperature Rise, Sea Level rise, Coastal Erosion and landslides, Coastal Flooding,WetlandsandEstuarieslossImpactof oceancurrentonglobalclimate,EL-NINO&LA-NINAeffects.

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture.

Module-4

KyotoProtocol:Importance,SignificanceanditsroleinClimateChangeCarbonTrading- Mechanisms , Various Models (European, Indian) Global and Indian Scenario.

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture

Module-5

Cleaner Development Mechanisms: Various Projects related to CO2 Emission Reduction, Alternatives of Carbon Sequestration: Conventional and non conventional techniques , Role of Countries andCitizens in Containing Global Warming.

(8hrs)

Teaching-LearningProcess	Chalk and Talk, PowerPoint Presentation and Video Lecture

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

SuggestedLearningResources:
Books

- BarryR.G.,andChorleyR.L.,"Atmosphere,WeatherandClimate",4thEdition,ELBSPublication. Bolin B., (Ed.), "Carbon Cycle Modelling", John Wiley and Sons Publications.
- FrancisD.,"GlobalWarming:TheScienceandClimateChange",OxfordUniversityPress.
- LindenE.,,"TheWindsofChange:Climate,WeatherandtheDestructionofCivilizations", SimonandSchusterPublications.
- MintzerI.M.,(Ed.),"ConfrontingClimateChange,Risks,ImplicationsandResponses", CambridgeUniversityPress.
- SrivatsavaA.K.,"GlobalWarming",APHPublications.
- Yadav,ChanderandBhan,"GlobalWarming:India'sResponseandStrategy",RPH Publications.

SkillDevelopmentActivitiesSuggested

- Rasteranalysis(QGIS)
- Useofpublicdomaindataandanalysis

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	knowtheimpactsthatclimatechangeishavingonthenatural environment	L1
CO2	understandcausesandImpactofclimatechangeandsomealternativesolutionstorestrict globalwarming	L3
CO3	Recognisehowsystems workbyseeingtherelationshipsbetween climateandother forms of environmental change.	L2

Mapping of Cos and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	2	3	3	2	2	1	1
CO2	3	2	2	2	1	2	2	2	1	2	1	2
CO3	3	2	1	1	1	1	2	2	1	2	1	1

ENVIRONMENTAL POLLUTION AND CONTROL MANAGEMENT			
CourseCode	**MCEE216B**	CIEMarks	50
TeachingHours/Week(L:P:SDA)	02:00:02	SEEMarks	50
TotalHoursofPedagogy	40 hours teaching	TotalMarks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- TounderstandthevarioustypesofEnvironmentalpollutions&Controltechniques, impactof Pollutants through Air, Water and Soil.

Module-1

Introduction: EnvironmentalPollutionand Sources,typesofpollutionand their Global, regionaland local environmental effects.
AirPollution: Classificationsandsourcesofairpollutants.Secondarypollutantsandformationof Photo-chemical Smog, PAN, PBN, Acid rain; Atmospheric Diffusion and Plume Behaviour, Effects of air pollutants on plants.

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture

Module-2

Water Pollution: Sources of water and their contamination, Types of pollutants, Industrialeffluents- pulp and paper mills, Sugar, Distillery, Domestic wastes, Effluents from water treatment plants. Eutrophication – causes, effects and control measures.
Soil pollution: Plants as soil pollution indicators, Formation of salts in soils,Causes of soil pollution, Effects of Fungicides and weedicides on soil components and pollution. Different kinds of synthetic fertilizers (N, P, K), their toxicity andEnvironmental effects, control of soil pollution.

(8hrs)

Teaching-LearningProcess	. Chalk and Talk, PowerPoint Presentation and Video Lecture

Module-3

Radioactive Pollution: Types of radiations (Alpha, Beta,Gamma), Units of radioactivity, Sources of radioactivematerial in environment, Biological impact and healthhazards associated with radiation, control of Radioactivepollution. Fate and movement of radioactive material inenvironment.
Heavy Metal Pollution: Sources of heavy metals,Accumulation of heavy metals in abioticenvironment andbiotic components, Bioaccumulation, Bio-magnification,Toxic effects (Lead, Mercury, Arsenic).

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture

Module-4

NoisePollution: Basicpropertiesofsound,Units,SourcesofNoisePollution,Effectsof noisepollution, Measurement ofsound. Measures to control noise pollution in industries -automotive type silencers, vibration isolation, damping,lagging. Protection of personnel – ear plugs, ear muffs, helmets, isolation.

Thermalpollution: DefinitionandSources,effectsofthermalpollution–physical,chemical, biological, control ofthermal pollution.

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture

Module-5

Oil pollution: introduction, major oil spills in the world, fateand movement of oil after spillage - spreading, evaporation, emulsification, dispersion, dissolution, sedimentation,biodegradation. Effects and control of oil pollution, Remote sensing in water quality monitoring.

(8hrs)

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation and Video Lecture

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

SuggestedLearningResources:

Books

1. S.S.Dara,EnvironmentalChemistryandPollutionControl,S. Chand and Co Ltd., New Delhi.
2. Environmental.ProtectionandPollutionControlManual – KarnatakaStatePollutionCentralBoard.
3. B.K.Sharma,andH.Kaur,EnvironmentalChemistry.
4. HandbookofEnvironmentalHealthandSafety–principleand practices , Vol. II.

WeblinksandVideoLectures(e-Resources):

- https://nptel.ac.in/courses

SkillDevelopmentActivitiesSuggested

- involvingstudentsindiscussionsforgivingremedialmeasuresofenvironmentalpollutioncontrol

Courseoutcome(CourseSkill Set)

At the end of the course the student will be able to :

Sl.No.	Description	BloomsLevel
CO1	TounderstandthevaroustypesofEnvironmentalpollutions&Control techniques.	L2
CO2	TounderstandtheImpactofPollutiononEnvironmentalSystem	L2
CO3	Tounderstandthemonitoringandassessingtheimpactof Pollutants through Air, Water and Soil.	L1,l2
CO4	ToknowtheconceptofRadioactivepollution,ThermalPollution,Heavy metalinterferenceandOilPollutionandtheir effects.	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	1	2	1	1	1	1	1
CO2	2	2	2	1	1	1	1	1	1	1	1	1
CO3	3	2	2	2	2	2	3	3	2	2	2	1
CO4	3	2	2	2	2	2	2	1	1	1	1	1

OPERATION AND MAINTENANCE OF ENVIRONMENTAL FACILITY			
CourseCode	**MCEE216C**	CIEMarks	50
TeachingHours/Week(L:P:SDA)	02:00:02	SEEMarks	50
TotalHoursofPedagogy	40hoursofteaching	TotalMarks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- Thecourseencompassestheaspectsofoperationandmaintenanceof Environmentalfacilities.
- Ithighlightstheoperationalproblemsandsuggeststhecontrol,preventiveandcorrective measures.

Module-1

Operation&MaintenancePlanning-OrganizationalStructure,WorkPlanning,Preparationand Scheduling,CostEstimates.

(8hrs)

Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.
Module-2	
DataBaseofFacilitiesforO&M–DetailedPlans,Drawings, Operation Manuals,Recordkeeping,standardoperatingprocedureandComputerApplicationsinO&Mand SCADA. (8hrs)	
Teaching-LearningProcess	Chalkandtalk,powerpointpresentationandvideolecture.
Module-3	
O&MofWaterTreatmentandSupplyandFacilities,OperationalProblemsandCorrectiveMeasures inDifferentUnitsofTreatment.WaterDistributionNetwork. (8hrs)	
Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.
Module-4	
O&MofWastewaterCollectionandTreatment Facilities,Operational Problemsand Corrective MeasuresinDifferentUnitsofTreatment,sewernetworksystem.O&M of Industrialwastewatersystems. (8hrs)	
Teaching-Learning	Chalkandtalk,powerpointpresentationandvideolecture.
Process	
Module-5	
O&MofAirPollution ControlFacilities,OperationalProblemsandCorrectiveMeasuresinDifferent UnitsofTreatment. (8hrs)	
Teaching-Learning Process	Chalkandtalk,powerpointpresentationandvideolecture.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

SuggestedLearningResources:

Books

3. .HammerM.J.,andHammerJr.M.J.,(2008),"WaterandWastewaterTechnology",PrenticeHallofIndia Pvt. Ltd.,NewDelhi.
4. MetcalfandEddyInc.,(2003),"WastewaterEngineering-TreatmentandReuse",4thEdition,Tata McGrawHillPublishingCo. Ltd., NewDelhi
5. CPHEEOManual.,(1991)"Water Supply&Treatment", GOIPublication.
6. CPHEEOManual.,(1995)onSewerage&SewerageTreatment,GOIPublication,.
7. NationalSafetyCouncilandAssociate(Data)PublishersPvt.Ltd.,(1991),"IndustrialSafetyand PollutionControlHandbook".

WeblinksandVideoLectures(e-Resources):

- NPTEL

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	Knowthescope,types,basicprinciples,organizationalstructure,work planningandschedulingandcostestimatesofO&M.	L1
CO2	Explaintheimportanceofplans,drawing,map,recordkeeping.Recognize theneedforoperationalmanualandSOP.Discusstheadvantagesand limitations of SCADA based control systems.	L2
CO3	Identifyandlisttheoperationalproblemsinwatertreatmentandsupply facilities.Applypreventiveandcorrectivemaintenance measures.	L4
CO4	Describe the operationalproblemsin wastewater(Domestic and Industrial) collectionandtreatment facilities.Enumeratetheremedialmeasures.	L1,L2
CO5	Identifyanddiscussthetroublesinairpollutioncontrolsystemsandsuggest the preventive and control measures.	L1,L2,L3

MappingofCOSandPOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	1	1	2	2	1	2	1	1
CO2	2	2	3	2	3	3	2	2	1	2	1	1
CO3	2	2	1	2	3	1	2	1	2	1	2	2
CO4	3	2	1	2	2	1	2	1	2	1	1	1
CO5	2	2	2	2	1	2	2	2	1	2	1	1

Program Outcome of this course

Sl. No.	Description	PO's
1	Qualitative improvement in Civil Engineering education	PO1
2	To identify the specific Environmental innovative ideas and creating mathematical tools	PO2
3	Design a complex environmental system with consideration for public health and safety, as well as cultural, societal, and Environmental implications.	PO3
4	Research based knowledge and research method is adopted to solve the complicated problems in Environmental Engineering	PO4
5	Mathematical modelling tools are used in prediction and analysis of complex Environmental Engineering activities	PO5
6	Societal framework for Environmental Engineering assessment and consequent responsibilities	PO6
7	To understand the concept of Environmental Engineering for sustainable development	PO7
8	Subject specific skill development	PO8
9	Socio-economic development through efficient project management	PO9
10	Providing inputs for transparent administration through e-governance	PO10
11	Innovation and creativity through research and development	PO11
12	Entrepreneurship	PO12

ENVIRONMENTAL ENGINEERING LABORATORY			
Course Code	MCEEL207	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	01:02:00	SEE Marks	50
Credits	02	Exam Hours	03

Course objectives:

- The lab course provides an opportunity to collect and preserve water samples from different sources, conduct various tests on water quality parameters, perform experiments on selected lab scale treatment processes.
- Italsoenrichesthestudentknowledgeof determiningcoagulantdose,efficiencyofsettling basin.

Sl.NO	Experiments
1	Determination of pH, Acidity and Alkalinity
2	Determination of Calcium, Magnesium and Total Hardness
3	Determination of Chloride
4	Determination of Dissolved Oxygen. Determination of BOD
5	DeterminationofOptimumCoagulantDoseusingJarTestApparatus forgivenwater samples
6	Determination of percentage of available chlorine in bleaching powder. Determination of Residual Chlorine
7	Determination of Solids in Sewage: I) Total Solids, II) Suspended Solids, III) Dissolved Solids, IV) Volatile Solids, Fixed Solids, V) Settle able Solids.
8	SolidWasteandleachate analyses:,for–Moisturecontent,organic content,pH,
9	SolidWasteandleachate analyses:,for–Sulphur,carbon,nitrogen andTracemetals.
10	SamplingandanalysisofambientairInstrumentalmethodsofanalysesforparticulates, PM10, PM2.5, HC,

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Acquaint with precision and accuracy of analytical data and to appreciate rounding off to a significantvalueinthecontextofwaterqualityparameters.Applyvariousmethodsofsample preservation and conduct titrimetric and instrumental analyses on water samples
- Carryoutjartest foroptimum doseof coagulantand settling
- Understandthesignificanceofbreakpointchlorinationandtoanalysethepercentageof chlorine in bleaching powder

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination(SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- **Total marks scored by the students are scaled down to 30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 01 tests for 100 marks, test shall be conducted after the 14th week of the semester.
- In test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- **The test marksis scaled down to 20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and marks of test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly

by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Suggested Learning Resources:

- Manual on water supply and Treatment, CPHEEO, Ministry ofUrban Development, GoI,New Delhi, 1999.
- "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development,GoI, New Delhi,
- SoftwarePackageManualonBRANCH,LOOP,SEWER– UNDP/UNEP.
- Wark.K,WarnerG.F.andDavis W.T –AirPollution itsoriginandcontrol, Addison-Wesley,
- "StandardMethods for the Examination of Water and Wastewater", 21th Edition, AmericanPublic Health Association, Washington. D.C . 2005

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Acquire capability to conduct experiments and estimate the concentration of different parameters.	L1
CO2	Compare the result with standards and discuss based on the purpose of analysis.	L1,L2
CO3	Determine type of treatment, degree of treatment for water and waste water.	L1,L2
CO4	To carryout the solid waste leachate characteristics and to air quality monitoring	L2,L3
CO5	Identify the parameter to be analyzed for the student project work in environmental stream.	L3.

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**			**1**		**2**	**1**	**2**	**2**	**2**	**1**	**1**
CO2	**2**			**1**		**2**	**1**	**2**	**1**	**2**	**1**	**1**
CO3	**2**			**1**		**2**	**1**	**2**	**1**	**2**	**1**	**1**
CO4	**2**			**1**		**2**	**1**	**2**	**2**	**2**	**1**	**1**
CO5	**2**			**1**		**2**	**1**	**2**	**2**	**2**	**1**	**1**