Curriculum Structure
For
M. Tech. Environmental Engineering

(In light of NEP2020)

NCrF Level 7

For students admitted in 2023-24 onwards

Govt. College of Engineering, Amravati

(*An Autonomous Institute of Govt. of Maharashtra*)

Near Kathora Naka, Amravati, Maharashtra

PIN 444 604

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Member Secretary | BoS Chairperson | Dean (Academics) | Principal

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(An Autonomous Institute of Govt. of Maharashtra)

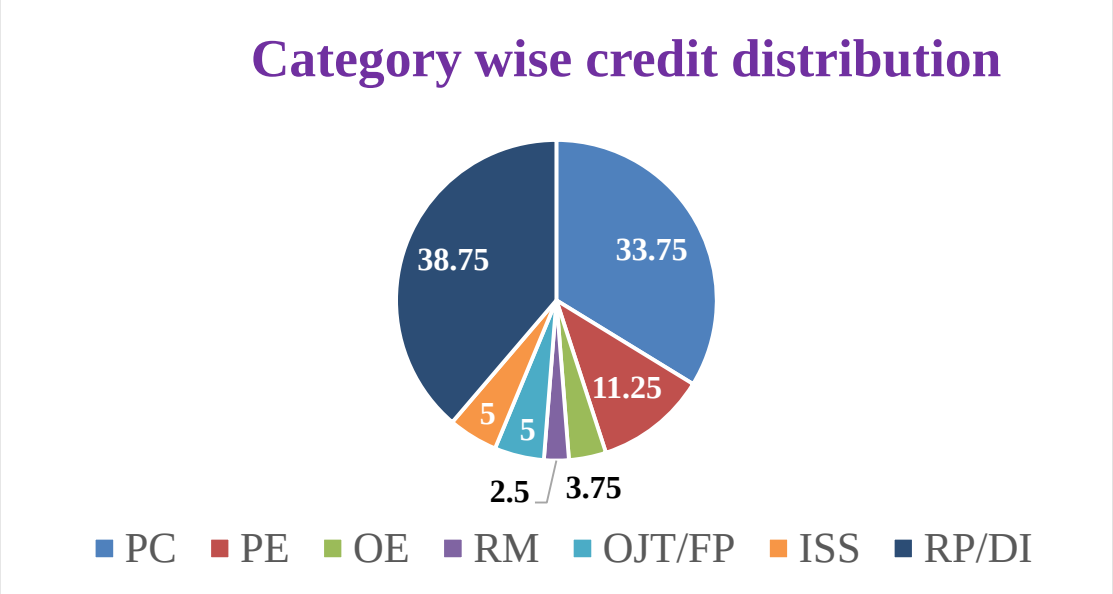
Curriculum Structure for M. Tech. Environmental Engineering

(In light of NEP 2020)

Category wise credit distribution:

Semester	PC	PE	OE	RM	OJT / FP	ISS	RP / DI	Total
I	15	03	---	---	---	02	---	20
II	12	03	---	02	---	02	---	19
III	---	03	03	---	04	---	13	23
IV	---	---	---	---	---	---	18	18
Total	**27**	**09**	**03**	**02**	**04**	**04**	**31**	**80**

SN	Abbreviation	Meaning	Credits	Percentage
01	PC	Programme Core	27	33.75
02	PE	Programme Elective	09	11.25
03	OE	Open Elective	03	03.75
04	RM	Research Methodology	02	02.50
05	OJT	On-Job Training/ Internship	04	05.00
06	FP	Field Projects		
07	ISS	Independent Study & Seminar	04	05.00
08	RP	Research Project	31	38.75
09	DI	Dissertation		
		Total	80	100.00



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General Instructions:

1) 10% content of syllabus of each theory course of first, second and third semesters shall be completed by the students with self-study. The 10% portion of each course (for self-study) shall be declared by the concerned course-coordinator at the beginning of teaching of the course.

2) Student can complete any two theory courses of second semester in "online" mode, offered through SWAYAM/ NPTEL. In this case –
   i) Students can register and complete these online courses any time after beginning of first semester, however, the student must successfully complete and pass the course, and submit the score card/certificate before declaration of result of second semester.
   ii) In case if a student registers for a course in online mode but fails in the course the student will have to register for the course in the institute whenever it is offered. In this case, the student will have to attend the classes of the course (in order to satisfy the minimum attendance criteria), appear for all the examinations (MSE, TA, ICA, ESE etc) of the course, and successfully complete the course with at least D grade.

3) Student can complete the two theory courses of third semester in "online" mode, offered through SWAYAM/ NPTEL. In this case –
   i) Students can register and complete these online courses any time after beginning of first semester, however, the student must successfully complete and pass the course, and submit the score card/certificate before declaration of result of third semester.
   ii) In case if a student registers for a course in online mode but fails in the course the student will have to register for the course in the institute whenever it is offered. In this case, the student will have to attend the classes of the course (in order to satisfy the minimum attendance criteria), appear for all the examinations (MSE, TA, ICA, ESE etc) of the course, and successfully complete the course with at least D grade.

4) Students must complete On-the-job training/ Internship/ Field work for a duration of minimum four weeks during summer break, after completion of second semester of first year in the respective major subject. The assessment of the same shall be done in third semester. The company/ organization for On job training/ Internship/ Field work must be approved by the DFB.

5) Students going for industrial project or going for dissertation at some other institute (during third and fourth semester) shall complete the courses Programme Elective – III and Open Elective in any one of the two modes
   i) Online courses offered through SWAYAM/ NPTEL: In this case the student must complete the course and submit the score card/ certificate before commencement of fourth semester. Students can register and complete these courses any time after beginning of first semester

ii) Self-study mode: In this case the student will have to study the course of his/her own. The student shall appear for all the college assessments/ examinations (MSE, TA and ESE) personally as per the schedule declared by the institute. This facility can be availed only by the students who are going for industrial project or going for dissertation at some other institute.

6) **Maximum period for completion of M. Tech. programme:**

The maximum duration for completion of the PG full time programme is eight semesters from the date of initial registration. The maximum duration of the programme includes the period of withdrawal, absence and different kinds of leaves permissible to a student but it shall exclude the period of rustication of the student from the institute and it shall also exclude the period lapsed between exit after first year (second semester) and reentry at second year (third semester). However, genuine cases on confirmation of valid reasons may be referred to Academic Council for extending this limit by additional one year.

PROGRAM OBJECTIVES

Post Graduate Environmental Engineering Student should

1. Visualize, formulate, and mitigate Environmental related issues.
2. Develop and adopt sustainable technology for Industrial Development.
3. Understand the importance of professional and ethical responsibilities.
4. Acquire zeal and enthusiasm of lifelong learning to cope up with Global trends.

PROGRAMME OUTCOMES

Post Graduate Environmental Engineering Student will be able to:

1. Resolve the Environmental related issues.
2. Adopt sustainable technology for Industrial Development.
3. Shoulder professional and ethical responsibilities.
4. Develop zeal and enthusiasm of lifelong learning to cope up with Global trends.
5. Develop zeal and enthusiasm of lifelong learning to cope up with Global trends

M. Tech. (Environmental Engineering) Semester I

Category	Course Code	Name of the course	Teaching Scheme				Examination Scheme						Credits
							Theory			Practical		Total	
			Theory	Tut	Pract	Total	MSE	TA	ESE	ICA	ESE		
PC	CE 2111	Environmental Science and Chemistry	04	--	--	04	30	10	60	---	---	100	04
PC	CE 2112	Environmental Microbiology and Biological Processes	04	--	--	04	30	10	60	---	---	100	04
PC	CE2213	Advanced Water Treatment	04	--	--	04	30	10	60	---	---	100	04
PE	CE 2114	Program Elective I	03	--	--	03	30	10	60	---	---	100	03
PC	CE2115	Environmental Engineering Laboratory I	--	--	06	06	--	--	--	50	50	100	03
ISS	CE2116	Seminar – I	--	--	01	01	--	--	--	50	---	50	02
		Total	15	--	07	22	120	40	240	100	50	550	20

List of (CE 2114) PROGRAM ELECTIVE I	
A	Solid and Biomedical Waste Management
B	Hazardous Waste Management
C	Environmental Geo-technology

Note:

1) The contact hours for the students (with concerned supervisor) for Seminar – I shall be one hour per week per student, subject to maximum of four hours per week

2) The hours shown in the teaching scheme for Seminar I are the contact hours for the students with concerned supervisor. Each student is expected to devote at least four hours per week for Seminar I

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M. Tech. (Environmental Engineering) Semester II

Category	Course Code	Name of the course	Teaching Scheme				Examination Scheme						Credits
							Theory			Practical		Total	
			Theory	Tut	Pract	Total	MSE	TA	ESE	ICA	ESE		
PC	CE 2211	Advanced Wastewater Treatment	03	--	--	03	30	10	60	--	--	100	03
PC	CE2212	Industrial Wastewater Treatment	03	--	--	03	30	10	60	--	--	100	03
PC	CE 2213	Air Quality Monitoring and Control	03	--	--	03	30	10	60	--	--	100	03
PE	CE 2214	Program Elective II	03	--	--	03	30	10	60	--	--	100	03
RM	SH 2201	Research Methodology	02	--	--	02	30	20	--	--	--	50	02
PC	CE 2215	Environmental Engineering Laboratory II	--	--	06	06	--	--	--	50	50	100	03
ISS	CE 2216	Seminar – II	--	--	01	01	--	--	--	50	--	50	02
OJT/FP		OJT/FP	--	--	--	--	--	--	--	50	--	50	04
		Total	14	--	07	21	150	60	240	150	50	650	23

CE 2214 - PROGRAMME ELECTIVE - II	
A	Environmental Impact Assessment and Management
B	Environmental Management and Auditing
C	Environmental Statistics and Optimization Techniques
D	Bioremediation: Principles and Applications

Note:

i) The contact hours for the students (with concerned supervisor) for Seminar – II, shall be one hour per week per student, subject to maximum of four hours per week.

ii) The hours shown in the teaching scheme for Seminar II are the contact hours for the students with concerned supervisor. Each student is expected to devote at least four hours per week for Seminar II.

iii) Individual students are required to choose a topic of their interest for Seminar II. They shall acquire state-of-the art knowledge in that area and shall define the grey area related to topic (gap analysis) so as to carry dissertation in that area. The students are required to review literature on the topic and deliver seminar.

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Exit option:

- The exit option at the end of one year of the Master's degree program willcommence from AY 2024-25.
- Students who have joined a two-year Master's degree program may opt for exit at the end of the first year and he/ she shall be eligible for M. Voc. Degree (Level 6.5)
- The M. Voc. Degree may be awarded to a student provided they have earned all 43 credits of first year (first and second semester) including 04 credits of On-job training / Internship/ Field work. The On-job training / Internship/ Field work shall be completed during summer break, after completion of the second semester of the first year in the respective Major Subject.
- Even if, a student exits after third semester, the M. Voc. Degree may be awarded to him/ her provided he/ she have earned all 43 credits of first year (first and second semester) including 04 credits of On-job training / Internship/ Field work. The On-job training / Internship/ Field work shall be completed during summer break, after completion of the second semester of the first year in the respective Major Subject.
- The student must submit the report of On-job training / Internship/ Field work, in the format prescribed by the institute, as partial fulfilment of award of M. Voc. degree.
- Re-entry to complete the PG degree, after taking the exit option, will be permissible up to 05 years from the date of admission to the PG programme. Such students, shall have to surrender the M. Voc. Degree, at the time of re-entry. There shall be a gap of at least six months between exit after first year and re-entry to PG degree at third semester

M. Tech. (Environmental Engineering) Semester III

Category	Course Code	Name of the course	Teaching Scheme				Examination Scheme						Credits
							Theory			Practical		Total	
			Theory	Tut	Pract	Total	MSE	TA	ESE	ICA	ESE		
PE	CE 2311	Program Elective III	03	--	--	03	30	10	60	--	--	100	03
OE	SH 2301	Open Elective	03	--	--	03	30	10	60	--	--	100	03
RP/DI	CE 2313	Dissertation Stage – I	--	--	04	04	--	--	--	150	--	150	13
		Total	06	--	04	04	60	20	120	200	--	400	23

Note: The hours shown in the teaching scheme for Dissertation Stage I are the contact hours for the students with concerned supervisor. The student is expected to devote at least twenty-six hours per week for Dissertation Stage I.

LIST OF PROGRAMME ELECTIVE III AND OPEN ELECTIVES

CE 2311 PROGRAMME ELECTIVE -III		SH 2301 OPEN ELECTIVE	
A	Artificial Intelligence and Machine Learning	A	Industrial Safety
B	Water Supply and Wastewater Collection Systems	B	Operations Research
C	Remote Sensing and GIS in Environmental Engineering	C	Project Management
D	Environmental Systems Modeling and Statistics	D	Data Structure and Algorithms
E	Rural Water Supply and Sanitation	E	Nano Technology

M. Tech. (Environmental Engineering) Semester IV

Category	Course Code	Name of the course	Teaching Scheme				Examination Scheme						Credits
							Theory			Practical		Total	
			Theory	Tut	Pract	Total	MSE	TA	ESE	ICA	ESE		
RP/DI	CE 2411	Dissertation Stage – II	--	--	04	04	--	--	--	100	200	300	18
		Total	--	--	04	04	--	--	--	100	200	300	18

Note:

1. Dissertation Stage – I is pre-requisite for Dissertation Stage – II

2. The hours shown in the teaching scheme for Dissertation Stage II are the contact hours for the students with concerned supervisor. The student is expected to devote at least thirty-six hours per week for Dissertation Stage II.

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Comparison of existing and new programme structure:

i) On the basis of Marks and Credit:

Semester	Marks		Credits	
	Existing	**New**	**Existing**	**New**
I	610	550	17	20
II	600	600	19	19
III	300	400	16	23
IV	400	300	16	18
Total	**1910**	**1850**	**68**	**80**

ii) On the basis of semester wise number of courses:

	Number of courses									
	Semester I		Semester II		Semester III		Semester IV		Total	
	Existing	New	Existing	New	Existing	New	Existing	New	Existing	New
Theory	05	04	05	05	02	02	---	---	12	11
Practical	01	01	01	01	---	---	---	---	02	02
Seminar	01	01	01	01	---	---	---	---	02	02
Internship	---	---	---	---	---	01	---	---	---	01
Dissertation	---	---	---	---	01	01	01	01	02	02

iv) On the basis of course category:

v)

Course category	Number of courses		Credits	
	Existing	**New**	**Existing**	**New**
PC	08	08	24	27
PE	03	03	09	09
OE	02	01	03	03
RM	01	01	02	02
OJT / FP	---	01	---	04
ISS	02	02	04	04
RP / DI	02	02	26	31
Total	**18**	**18**	**68**	**80**

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Department of Civil Engineering

Equivalence Scheme

Programme Name: M. Tech. (Environmental Engineering)

SEMESTER I						
Sr. No.	**Course code with Name of course (Previous w.e.f 2019-20)**		**Credit**	**Course code with Name of course (w.e.f 2023-24)**		**Credit**
1	CEP141	Environmental Science and Chemistry	3	CE 2111	Environmental Science and Chemistry	4
2	CEP142	Environmental Microbiology and Biological Processes	3	CE 2112	Environmental Microbiology and Biological Processes	4
3	CEP143	Advanced Water Treatment	3	CE2213	Advanced Water Treatment	4
4	CEP144 A	Program Elective I Solid and Biomedical Waste Management	3	CE2114 A	Program Elective I Solid and Biomedical Waste Management	3
5	CEP144 B	Program Elective I Hazardous Waste Management	3	CE2114 B	Program Elective I Hazardous Waste Management	3
6	CEP144 C	Program Elective I Environmental Geo-technology	3	CE2114 C	Program Elective I Environmental Geo-technology	3
7	CEP145	Environmental Engineering Laboratory I	3	CE2115	Environmental Engineering Laboratory I	3
8	CEP146	Seminar I	2	CE 2116	Seminar I	2
9	SHP121	Audit Course	0	-	No Equivalence	
SEMESTER II						
1	CEP241	Advanced Wastewater Treatment	3	CE 2211	Advanced Wastewater Treatment	3
2	CEP242	Industrial Wastewater Treatment	3	CE 2212	Industrial Wastewater Treatment	3
3.	CEP243	Air Quality Monitoring and Control	3	CE 2213	Air Quality Monitoring and Control	3

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4	CEP244 A	Program Elective II Environmental Impact Assessment	3	CE2214 A	Program Elective II Environmental Impact Assessment	3
5	CEP244B	Program Elective II Environmental Management and Auditing	3	CE2214 B	Program Elective II Environmental Management and Auditing	3
6	CEP244C	Program Elective II Environmental Statistics and Optimization Techniques	3	CE2214 C	Program Elective II Environmental Statistics and Optimization Techniques	3
7	CEP244D	Program Elective II Bioremediation: Principles and Applications	3	CE 2214 D	Program Elective II Bioremediation: Principles and Applications	3
8	SHP221	Research Methodology	2	SH 2201	Research Methodology	2
9	CEP245	Environmental Engineering Laboratory II	3	CE 2215	Environmental Engineering Laboratory II	3
10	CEP246	Seminar II	2	CE 2216	Seminar – II	2
SEMESTER III						
1.	-	No Equivalence	-	CE 2311 A	Program Elective III Artificial intelligence and Machine Learning	3
2	CEP341 A	Program Elective III Water Supply and Wastewater Collection Systems	3	CE 2311 B	Program Elective III Water Supply and Wastewater Collection Systems	3
3	CEP341 B	Program Elective III Remote Sensing and GIS in Environmental Engineering Techniques.	3	CE 2311 C	Program Elective III Remote Sensing and GIS in Environmental Engineering Techniques.	3
4	CEP341 C	Program Elective III Environmental Systems Modeling and Statistics	3	CE 2311 D	Program Elective III Environmental Systems Modeling and Statistics	3
5	CEP341 D	Program Elective III Rural Water Supply	3	CE 2311 E	Program Elective III Rural Water Supply and	3

		and Sanitation			Sanitation	
6	CEP341 E	Program Elective III Soft Computing Techniques	3	CE 2311 F	Program Elective III Soft Computing Techniques	3
8	SHP321	Open Elective	3	SH 2301	Open Elective	3
9	-	No Equivalence		CE 2312	On Job Training /Field Work/ Internship	4
10	CEP342	Dissertation Phase I	10	CE 2313	Dissertation Stage – I	13
SEMESTER IV						
1	CEP 441	Dissertation Phase II	16	CE 2411	Dissertation Stage – II	18

Course Code	CE2111							Course category		PC
Course Name	ENVIRONMENTAL SCIENCE AND CHEMISTRY									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
04	-	-	04	30	10	60	2 hrs 30 min	-	-	100	04

Course Objectives:

1. To study the ecosystem
2. To study various pollutants responsible for Global Atmospheric Change
3. To study the Chemistry involved in water and wastewater treatment
4. To study the composition and characterisation of sewage and sewage sludge
5. To study the fundamental principles and uses of chromatography in Environmental Engineering field

Course Contents:

Ecology:

Introduction, Energy flow in Ecosystems, food chain and trophic levels, Nutrient cycles, elements of limnology, Eutrophication

Global Atmospheric Change:

The greenhouse effect and stratosphere ozone depletion, Global temperature, the greenhouse effect, carbon dioxide, chlorofluorocarbon, the greenhouse gases, Regional effects of greenhouse gases, perspective on global atmospheric change.

Introduction to Climate Change:

Changing patterns of human habitation due to industrialisation, Changes in the ecosystem due to industrialisation, Changes in the climate due to Industrial activity, Changes in the global rain fall pattern

Earth's Carbon reserve:

Carbon Cycle, Carbon flow through life cycle, conversion of carbon into various polluting and non-polluting forms, Global carbon balance, Imbalance in carbon cycle due to human activity

Climatic Changes through the ages:

Natural climatic pattern changing through the ages, Response of ecosystem to changing climatic changes, acceleration of climate change due to human activity, Effects of climate change on human life, Rise of

temperature and its probable impact on future life

General Chemistry:

Law of mass action, Stoichiometry, Gas Laws

Physical Chemistry:

Types of solution, electrical conductivity and aqueous solution, ionic theory, electrical dissociation, Buffer solutions, Indicators, Solubility products, Common ion effect, Amphoteric hydroxides, chemical equilibria and ways of shifting it.

Organic Chemistry and Biochemistry:

Organic compounds of interest to environmental engineers, General preparation of the functional groups of organic compounds, Enzymes, classification, Enzyme carbolysed reactions. Break down and synthesis of carbohydrates, fats, protein under aerobic and anaerobic reactions, CNP cycle under aerobic and anaerobic reactions, Colloidal Chemistry, Dispersion of Colloids, General and electro kinetic properties of colloids, colloidal solutions and mixtures. Concept of BOD, COD, TOC

Environmental Chemistry:

Water structure and anomalous behaviour of water ,Chemistry involved in water treatment processes like coagulation, disinfection, softening, fluoridation defluoridation, Iron and its control Composition and characterisation of sewage, sewage sludge and gas analysis.

Reference Books and Websites:

1. Introduction to Environmental Engineering and Science, M Masters Gillbert, Prentice Hall Publication, New Delhi, 1995
2. Environmental Science & Engineering, Henrry, Prentice Hall College Div ,1989
3. Water and Wastewater Engineering, G M Fair, , J. C Geyer., D. A. Okun, Vol, I & II, John Wiley & Sons, New York, 1966
4. Chemistry for Environmental Engineering, Sawyer & M.C Carty, McGraw-Hill, 1994
5. Global Climate Change, M.Z.A Khan, Rawat Publications
6. Climate change and Agriculture over India, Rao and Prasad, PHI Publications
7. Climate Change and Biodiversity, Dr SS Khinchi, McGRAW HILL.
8. Waste Water Treatment, Disposal and Reuse, Met Calf & Eddy, Tata McGraw

Course Outcomes:

After successful completion of the course, students will be able to

CE2111.1: Apply the principles of Environmental Science to reduce the pollution of environment

CE2111.2: Apply the knowledge of General and Physical chemistry for water and wastewater treatments

CE2111.3: Design the water and wastewater treatment processes by applying the knowledge of Organic chemistry and Biochemistry

CE2111.4: Apply the knowledge of Colloidal chemistry for water and wastewater treatments

CE2111.5: Design the water and wastewater treatment processes by applying the knowledge of Environmental Chemistry

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2111.1	2	2	-	1	1
CE 2111.2	3	1	1	1	1
CE 2111.3	3	2	1	2	2
CE 2111.4	1	2	1	-	1
CE 2111.5	2	1	1	2	2

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE2112	Course category	PC
Course Name	ENVIRONMENTAL MICROBIOLOGY AND BIOLOGICAL PROCESSES		

Teaching Scheme				Examination Scheme							Credits
				Theory				Practical		Total	
Th	Tu	Pr	Total	MSE	TA	ESE	ESE Duration	ICA	ESE		
04	-	-	04	30	10	60	2 hrs 30 min	-	-	100	04

Course Objectives:

1. To make students understand about classification of microorganisms their characteristics and importance in the field of environmental engineering.
2. To make students aware of methods those are adopted for enumeration, isolation, straining and differentiation of bacteria.
3. To introduce students about microbiology of food which discuss the role of microbes in food production and food spoilage processes.
4. To make students understand about classification, sources and formation of enzymes.
5. To learn about fresh water biology including limnology, Lake Eutrophication, pathogens, diseases caused by them and their control.
6. To study the concept of pure and mixed culture of bacteria and laboratory culturing techniques.
7. To study different biological treatment technologies, air borne diseases and their control.

Course Contents:

Introduction to Microbiology:

Classification of microorganisms, procaryotic cells, eucaryotic cells, Characterization of microorganism, microorganism of importance, Distribution of biological forms, interrelationship application in the field of Environmental Engineering

Bacteria:

Distribution, cytology, forms size, morphology and file structure of bacteria, nutritional requirements, metabolism, growth of bacteria, growth patterns, food microorganism relationship, Aerobic, Anaerobic growth, Factor affecting growth, generation time

Bacteriology of Water:

Pathogens and indicator of pollution, method of isolation, enumeration and differentiation. Presumptive, confirmative and completed test for E-coli, most probable number, Membrane filter technique, indicators of pollution, sampling method, frequency, precautions

Microbiology of Food:

Microorganisms associated with milk and food, diseases transmitted, food poisoning, Enzymes Nature of enzymes, mode of actions, effect of temperature, pH, salts and heavy metal, extra cellular and intracellular enzymes classification, source of enzymes, enzymes formation

Fresh Water Biology:

Flora and fauna in rivers, distribution, limnology, biological cycles, oxygen concentration, nutrient concentration, oxygen depletion, oxygen sag reaeration, Lake eutrophication and its prevention

Algae, Fungi Protozoa and Viruses:

General, introduction to these groups, their role in environmental Engineering and their classification, identification, observation nutrition, reproductions, their control

Viruses: Occurrence, special features, diseases caused by them, culturing, control of viruses. Bacterial

Bacteria Culture:

Isolation of microorganisms, staining procedures, pure and mix cultures, culture characteristics, different medias, selective methods, interference, gram positive and negative bacteria laboratory culturing techniques, equipments used, microscope, autoclave, incubator, test chamber.

Microbiology of Waste Water Treatment:

Microorganisms, fundamental theory, theory of operations, oxygen requirements and environmental factors associated with following waste treatment methods.

- Activated sludge process
- Trickling filter
- Oxidation pond
- Sludge digestion
- Cesspools
- Septic tank and Imhoff tank

Air Microbiology:

Types of microorganisms, Air borne diseases, sampling of air, microbial content of air, control of airborne diseases. Control of microorganisms Death of bacteria Pattern of death, effect of temp, pH, toxic substances on growth of bacteria, Antagonism, and synergism, Control of microorganisms by physical agents, Control of microorganisms by chemical agents

Reference Books:

1. Microbiology for Environmental Scientist and Engineers, Anthony Gaudy, Elizabeth Gaudy,McGraw Hill Int. Book Co., 1980.
2. Microbiology for Sanitary Engineers, R. E. Mckinney, McGraw Hill Int. Book Co., 1967
3. Microbiology of Water and Sewage, P. L. Gainey., Prentice Hall Inc., 1952
4. Microbiology, M. J Pelczar., E. C. S. Chan, Tata McGraw Hill, 1986 5. Environmental Biology, Mukherjee, Tata McGraw Hill Publishing. Co. Ltd,1996

Course Outcomes:

On successful Completion of the course, students will be able to:

CE2112.1: Study the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes.

CE2112.2: Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures, enumeration of bacteria

CE2112.3: Know various Culture media and their applications and also understand various physical and chemical means of sterilization

CE2112.4: Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae

CE2112.5: Comprehend the different biological treatment technologies adopted for treatment, air borne diseases and their control.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2112.1	2	1	-	1	1
CE 2112.2	-	1	-	1	-
CE 2112.3	3	2	1	1	-
CE 2112.4	1	-	1	1	-
CE 2112.5	2	1	2	2	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE2113	Course category	PC
Course Name	ADVANCED WATER TREATMENT		

Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
04	-	-	04	30	10	60	2 hrs 30 min	-	-	100	04

Course Objectives:

1. To understand the importance of standards of treated water
2. To learn the various unit operations and processes of water treatment process
3. To study and design various miscellaneous treatment processes such as softening, fluoridation/de-fluoridation.
4. To design the conventional water treatment plant

Course Contents:

Standards for raw and treated waters:

Surface waters, Effects of storage on water quality, Limnology, Water ecology, Thermal stratification, Seasonal Change, lake overturns, Algae, Control measures, quality of underground Waters. Nature and source of impurities, Examination of waters

Requirements of water treatment facilities:

Process design and hydraulic design, Unit operations, Gravity systems, pumping systems, Period of design, Fluctuations in demand, Intake structures, Useful concepts from water chemistry and biology

Principles of Sedimentation and Floatation:

General equations for settling or discrete particulates, Hindred settling, effect of Temperature, viscosity efficiency of an ideal basin, short-circuiting. Sludge moisture content – specific gravity relationship. Up flow and sludge blanket tanks – mathematical model of the unit processes.

Theories of Chemical Coagulation:

Nature of colloids. Zeta potential, Coagulant and their specificity, Design of mechanical Flocculator. Mean velocity gradient “G”, “Gt” effect of temperature and other variables. Power consumption, Mathematical Modeling

Theory of Filtration:

System Parameter and mathematical modeling size and shape characteristics of granular filtering materials, Preparations of filter sand, Hydraulics of filtration through homogeneous and stratified beds. Performance of slow, rapid, high rate multiplayer and composite filters, Up flow, two way filter, dual media filter.

Pressure Filters:

Diatomaceous earth filters. Mico-strainers, Filterability Index

Principles of Disinfections:

Factors affecting disinfections, Halogens: Chlorine, Iodine and Bromine.

Principles of Aeration:

System parameters and mathematical model, Methods of aeration, Theories of adsorption, Freundlich equation, Removal of taste and odour by adsorption, Removal of colour, Effects of fluorides, Fluoridation, Removal of fluorides

Industrial water treatment:

Boiler feed water, softening of water, Langlier, Ryzner and other indices. Reuse of water and conservation of water in industry

Methods of Iron and Manganese removal:

Use of aeration, oxidation, ion-exchange and other methods and their control, Theory of corrosion, and corrosion control, Design of Conventional Water Treatment Plant

Design of Water Treatment Plant

Reference Books and Websites:

1. Water and Waste water Engineering, Fair Geyer and Okun, John Willy and Sons, 1966
2. Water and Waste water Technology, Mark J. Hammer, John Willy and Sons, 1986
3. Water Supply and Sewerage, E.W. Steel and McGhee, Mc Graw Hill Company, 1979
4. Manual on Water Supply & Treatment, CPHEEO, New Delhi. The Central Public Health and Environmental Engineering Organization Publication 3rd edition, May 1999
5. Physico-Chemical Processes for Water Quality Control, Weber, John Wiley & Sons, 1972.

Course Outcomes:

On successful Completion of the course, students will be able to:

CE2113.1: Explain the inter-relationship between water quality parameters and plant sizing,

CE 2113.2: Know the importance of hydraulics and layout.

CE 2113.3: Illustrate aeration, sedimentation, coagulation, and flocculation and filtration processes.

CE 2113.4: Know the importance and removal of trace organics.

CE 2113.5: Design Water treatment plant, sizing, hydraulics and layout.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2113.1	1	2	2	1	-
CE 2113.2	2	1	-	-	-
CE 2113.3	2	2	-	-	1
CE 2113.4	2	2	-	-	-
CE 2113.5	1	2	2	2	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE2114 (A)							Course category			PE
Course Name	SOLID AND BIOMEDICAL WASTE MANAGEMENT										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To make students aware about solid waste management system in developing countries along with the problems caused.
2. To give students detail idea about composition and characteristics of municipal solid waste.
3. To make students Study the concept of onsite handling of solid waste including its collection, transportation and proper disposal.
4. To study aerobic & anaerobic method of composting and biogas generation using solid waste.
5. To learn landfill and incineration method of solid waste disposal along with suitability and associated problems.
6. To make them aware of Legislation and byelaws associated with solid waste management.
7. To Study biomedical waste and its management.

Course Content:

Problems and impacts of solid waste in developing countries;

Sources, types and composition of Municipal solid waste, quantity estimation and forecast, Management systems and planning

Characteristics of solid waste:

Sampling – physical , chemical and biological analysis. Sources, types and composition of industrial hazardous and toxic wastes, Treatment and disposal methods

Collection of solid waste:

On site handling and processing; Collection systems and service; Analysis of collection systems, collection routes; Management issues and concerns,

Transfer and transport, design requirements

Composting:

Process microbiology, Aerobic and anaerobic composting, parameters affecting, Design considerations, compost control, engineering design and operations.

Sanitary Landfill:

Process mechanism, Classification, types, siting considerations, engineering design and operations

Incineration:

Process details, classification, types, siting considerations, Energy recovery, Pyrolysis, engineering design and operations

Biogas from solid wastes, conversion of solid wastes to protein, Legislation and byelaws in solid waste management, Solid Waste (Management & Handling) Rules, 2001

Biomedical waste categorization; generation, collection, transport, treatment and Disposal

Reference Books and Websites:

1. Municipal and Rural Sanitation. Ehlens and Steel; Tata McGraw-Hill, 1976.
2. Solid Waste Engineering – Principles and Managements Issues, G. Techbanoglous, H. Theisen and Elliasen, Mc-Graw Hill Inc., 1972
3. Water Supply for Rural Areas and Small Communities, Wagner E. G. and Lanoik J.N; Geneva, WHO Publication, 1989
4. Solid waste Engineering, Principles and management issues, G. Techbanoglous, Elliasen; Mc-Graw Hill Book Co.1985
5. Solid waste Management in developing Countries, Bhide A.D and Sudaresan B.B; INSDOC, New Delhi, 1983.
6. Solid Waste Management, D. Joseph Hagerty, Joseph L. Pavoni & John E. Heer Jr.;Van Norstrand ,Van Nostrand Reinhold, New York 1973.
7. Handbook of solid waste Management, Frank Kreith; 2nd edition, Mc-Graw Hill Inc. 2002
8. Management of Solid Waste in Developing Countries, Frank Flintoff; 2nd Edn, WHO publication, 1984CEP 144

Course Outcomes:

On successful Completion of the course, students will be able to

CE 2114(A).1: Illustrate the problems caused by improper solid waste management system in developing countries

CE 2114(A).2: Study the composition and characteristics of municipal solid waste along with collection, transportation and proper disposal of solid waste.

CE 2114(A).3: Explain aerobic & anaerobic method of composting and biogas generation using solid waste, biomedical waste and its management.

CE 2114(A).4: Know about the landfill and incineration method of solid waste disposal.

CE 2114 (A).5: Study Legislation and byelaws associated with solid waste management.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2114(A).1	2	2	2	1	-
CE 2114(A).2	2	1	1	-	1
CE 2114(A).3	2	2	1	1	-
CE 2114(A).4	1	1	1	1	1
CE 2114(A).5	1	-	3	2	2

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE2114 (B)							Course category		PE
Course Name	HAZARDOUS WASTE MANAGEMENT									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To Study the importance of hazardous waste management
2. To learn the various impacts of hazardous waste on environment
3. To study the process techniques and disposal of hazardous waste
4. To learn the various aspects of the disaster management

Course Contents:

Introduction to Hazardous Waste: Definition, Problems, general awareness, Industry and Government‟s perspective. Risk Assessments, Environmental legislation

Hazardous Waste Characterization and site Treatment. Introduction, study of characterization, Assessment of Hazardous sites, waste minimization and Resource Recovery, chemical, physical and biological treatment to Hazardous waste. Thermal process

Transportation of Hazardous wastes, container for Hazardous waste, bulk transport, Non bulk transport

Hazardous Wastes (Handling, Storage & Management) Rules: 1989 of MoEF. Introduction

Groundwater Contamination: Effect on human health, Historical uses and abuses, hydrology, Detection, Control and Mitigation of groundwater contamination.

Process Techniques and Disposal: Selecting the process, siting the facility, integrated landfill system as Disposal sites, developing a new facility, and operating a landfill.

Basic Disaster Management Aspects: The significance of Disaster, the Disaster threat, National Disaster Management policy, major Requirement for coping with Disaster Management cycle, Disaster and National Development, Disaster legislation, counter disaster resources. International Disaster Organisation, utilisation of Resources.

Long-Term Measures: Prevention, Mitigation. Major factors for occurrence of Disaster impact: - Response to Disaster impact: - Major post impact factors, Disaster management support requirements.

Reference Books

1. Hazardous Waste Management : Charles A. Wentz., McGraw-Hill, New York,1989
2. Hazardous Waste Minimization, Harry M. Preeman, McGraw-Hill, 1989
3. Hazardous Waste Chemistry, Toxicology and Treatment, Stanly E. Manahan, 1st edition, CRC-Press, 1990)
4. Disaster Management : A Disaster Manager"s Hand Book, W. Nick Carter, ADB Publ., Manila,1991
5. Hazardous Waste Management, Wentz, Charles A., McGraw-Hill, 1989
6. Hazardous Waste Management, LaGrega, Michael D. Buckingham, Philip L. Evans and Jeffrey C., McGraw-Hill, 1989

Course Outcomes:

On successful Completion of the course, students will be able to:

CE2114 (B).1: Explain the necessity of hazardous waste management

CE2114 (B).2: Know the various impacts of hazardous waste on environment

CE2114 (B) .3: Design process techniques and disposal methods of hazardous waste

CE2114 (B).4: Explain various aspects of the disaster management

CE 2114(B) 5: Study Legislation and byelaws associated with hazardous waste management.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2114(B).1	1	2	-	-	-
CE 2114(B).2	2	2	1	1	-
CE 2114(B).3	2	2	2	3	1
CE 2114(B).4	2	1	2	1	1
CE 2114(B).5	2	2	3	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE2114 (C)							Course category			PE
Course Name	ENVIRONMENTAL GEOTECHNOLOGY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To Study the regulatory requirements for disposal of wastes on land.
2. To Study characteristics and design of landfill sites for handling of solid wastes.
3. To study various design barriers for containment of slurry and solid wastes at landfills.
4. To Study reuse of waste materials in geotechnical constructions.

Course Contents:

Contamination: Surface & subsurface contamination, Sources and effects of subsurface contamination, Physical, Chemical and biological characteristics of solid waste, Identification, Characterization and regulatory requirements for disposal of hazardous, non- hazardous and domestic waste Soil-waste interaction, Effect of pollutants on soil properties

Contaminants of solid waste in landfills: Characteristics of solid wastes, Disposal of solid waste, Stabilization and solidification of solid waste, Waste containment, Solid waste Landfills and its components, Shape and size of landfills, Types of landfills, Site selection Impervious barriers for liners and Covers, Liner systems and cover systems, , Landfill construction and operation, Leachate generation, Leachate collection and detection system , Closure and post-closure care, Sustainable waste management, Ground water contamination associated with leachate transfer

Containment systems using Geo-membrane: Advantages of using composite barrier for Liners and Covers, Single composite liner system for MSW landfill, Double composite liner system for HW landfill, Stability of landfills.

Contaminants of slurry wastes: Slurry transported waste, Slurry Ponds and their operation, Embankment construction methods for ponds, Design aspects, Environmental impact and control,

Vertical barriers for containment: Contaminated sites, Types of vertical barriers, - Soil- bentonite slurry trench walls, and Cement-Bentonite slurry trench walls -construction and design aspects

Geotechnical reuse of Waste material: Waste reduction, Use of waste in Geotechnical construction, Waste characteristics for soil replacement, Transportation consideration, Engineering properties of waste, Waste material in embankment and fills

Member Secretary BoS Chairperson Dean (Academics) Principal

Reclamation of contaminated site, various methods

Reference Books

1. Mitchell, J.K and Soga, K., Fundamentals of Soil Behavior, John Wiley and Sons Inc., 2005.
2. Fang, H-Y., Introduction to Environmental Geotechnology, CRC Press,1997.
3. Daniel, D.E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993.
4. Rowe, R.K., Quigley, R.M. and Booker, J.R., Clay Barrier Systems for Waste Disposal Facilities, E & FN Spon, 1995.
5. Rowe, R.K,, Geotechnicaland Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
6. Reddi, L.N. and Inyang, H.F, Geoenvironmental Engineering-Principles and Applications, Marcel Dekker Inc, 2000.
7. Sharma, H.D. and Lewis, S.P, Waste Containment Systems, Waste Stabilization and
8. Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994.CEP 145 ENVIRONMENTAL ENGINEERING LABORATORY I

Course Outcomes:

On successful Completion of the course, students will able to:

CE2114(C).1: Use regulatory requirements for disposal of wastes on land.

CE2114 (C).2: Determine characteristics and carry out design of landfill sites for handling of solid wastes.

CE2114 (C).3: Study the contamination of soil due to pollutants

CE2114 (C).4: Select design barriers for containment of slurry and solid wastes at landfills.

CE2114 (C).5: Reuse waste materials in geotechnical constructions.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2114(C).1	1	1	-	-	-
CE 2114(C).2	1	1	1	1	-
CE 2114(C).3	2	1	1	1	1
CE 2114(C).4	2	2	1	1	2
CE 2114(C).5	2	2	2	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE2115							Course category			PC
Course Name	ENVIRONMENTAL ENGINEERING LABORATORY I										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
-	-	06	06	-	-	-	-	50	50	100	03

Course Objectives:

1. To study various characteristics of wastewater
2. To carry out various tests on wastewater
3. Study of instruments related with Environmental Microbiology practical
4. To carry the bacteriological examination

Course Contents:

PART I: ENVIRONMENTAL SCIENCE AND CHEMISTRY LAB

A. LABORATORY EXPERIMENTS:

1. Determination of Conductivity, pH, Turbidity of given water sample
2. Determination of Hardness of given water sample (Calcium and total by EDTA method)
3. Determination of Sulphate content in given water sample
4. Determination of Chlorides content in given water sample
5. Determination of Chlorine demand and residual Chlorine in given water sample
6. Determination of Nitrogen content (all types) in given water sample
7. Determination of DO, BOD of given sewage sample
8. Determination of COD, TOC in given sewage sample
9. Determination of Iron and Manganese content in given sample
10. Determination of Acidity and Alkalinity of given sample
11. Determination of Fluorides content in given sample
12. Determination of Solids (Fixed, suspended and Volatile) in given sample

B. FIELD VISITS:

Field visits shall be arranged to Water Treatment plant and Sewage Treatment plant. Report based on Field Visits shall be submitted by students.

PART II ENVIRONMENTAL MICROBIOLOGY AND BIOLOGICAL PROCESSES LAB

LABORATORY EXPERIMENTS

1. Study of instruments related with Environmental Microbiology practical.
2. Sampling procedure for bacteriological examination.
3. Preparation of differential Nutrient media for bacterial culture.
4. Study of Effect of pH on growth of bacteria.
5. Study of Effect of Temperature on growth of bacteria.
6. Study of Effect of Salt Concentration on growth of bacteria.
7. Study of Isolation of bacteria by various methods: Pour plate method, Spread plate method and streak plate method.
8. Preparation of Bacterial smear,
9. Staining of bacteria,
10. Enumeration of bacteria by various methods, plate count, M.F. technique.
11. Study of Motility of Bacteria; Hanging Drop Method.
12. Control of microorganisms.
13. Preservation of bacteria, Slant culture.
14. Test for Coliform bacteria.

Course Outcomes

After successful completion of the course, students will be able to:

CE 2115.1: Compare the characteristics of wastewater with standard values

CE2115 .2: Identify the pollutional strength of wastewater

CE2115.3: Carry out the bacteriological examination of water and wastewater

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CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2115.1	-	2	1	-	-
CE 2115.2	1	2	-	1	-
CE 2115.3	-	1	1	2	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Member Secretary BoS Chairperson Dean (Academics) Principal

Course Code	CE2116							Course category			ISS
Course Name	SEMINAR I										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
-	-	01	01	-	-	-	-	50	-	50	02

COURSE OBJECTIVES:

1. To know the state of the art in the relevant subjects of Environmental Engineering.
2. To know the experimental procedure to validate theories related to Environmental Engineering.
3. To know how to prepare and present research project.

Student has to select a topic for Seminar in consultation with the allotted guide, carry out literature review, submit the seminar Report and deliver the seminar based on it. It is to be evaluated internally by three member panel of examiners wherein guide should be one of the members of the panel.

Course Outcomes:

On successful Completion of the course, students will be able to

CE 2116.1: Illustrate the state of the art in the relevant subjects of Environmental Engineering.

CE2116 .2: Apply experimental or mathematical skill to validate theories to relevant subject

CE 2116 .3: Prepare and present the report with interpretation.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2116.1	1	1	-	1	-
CE 2116.2	1	-	1	-	1
CE 2116.3	1	-	2	2	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

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Course Code	CE 2211							Course category			PC
Course Name	ADVANCED WASTEWATER TREATMENT										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To understand the importance of wastewater treatment
2. To learn the process analysis in wastewater treatment
3. To study the principle of biological treatment of wastewater
4. To learn the various methods of sludge treatment
5. To provide the knowledge of various processes under advanced wastewater treatment.

Course Contents:

Introduction:

Objectives of waste water treatment, Purpose of advanced wastewater treatment, Wastewater quantity and transport and waste water characteristics. Alternative flowcharts function and basic principles involved in different units of conventional wastewater treatment plant.

Process Analysis:

Reaction and reaction kinetics, Mass balance, Reactors and their hydraulic characteristics, Practical aspects of reactor design.

Physical and Chemical Treatment:

Screening, Grit removal, flow equalizations, and mixing. Flocculation, sedimentation, flotation, Detailed principles and design aspects of Screening, Grit chamber and Sedimentation tank.

Principles of Biological Treatment:

Kinetics of biological growth, introduction to suspended and fixed film reactors, Concepts of gas transfer and solids separation, Nitrogen and Phosphorus removal from waste water, Concepts of aerobic and anaerobic treatment of waste water, Design of Activated Sludge system using biological process dynamics, Complete design details of Activated Sludge Process, Modifications of ASP, Process

concepts and design aspects of Trickling Filters, Rotating Biological Contactors (RBC), Fluidized bed reactor/treatment.

Sludge Treatment and Disposal:

Aerobic and Anaerobic digestion of sludge, sludge stabilization, dewatering, conditioning, and disposal

Tertiary Treatment:

Principles of tertiary treatment, theory of adsorption and factors affecting adsorption. Concepts and different methods of dissolved solids removal. Basic principles of Reverse Osmosis, Ultra-filtration, Electro dialysis, Desalination

Advanced waste water treatment:

Advanced wastewater treatments, Reuse and resource recovery. Recent developments in Wastewater Treatment

Design of Sewage Treatment Plant

Reference Books

1. Wastewater Engineering: Treatment, Disposal & Reuse, Metcalf & Eddy Inc. 6th edition, McGraw Hill, 2002.
2. Introduction to Environmental Engineering, P. A. Veslind, PWS, Publishing Company, Boston, 1997.
3. Wastewater Treatment and disposal, S.J. Arceivalla, Marcel Dekker, 1981.
4. Wastewater Treatment Plant Planning, Design and Operation, S.R. Quasim, Holt, Rinehart & Winston N.Y, 1985.
5. Activated Sludge Process: Theory and Practices, N.F Grey, Oxford University Press, 1990.
6. Water and Waste water Technology, Mark J. Hammer, John Willy and Sons, 1986

Course Outcomes

On successful Completion of the course, students will be able to

CE 2211.1: Explain the necessity of wastewater treatment

CE 2211.2: Illustrate the process analysis in wastewater treatment

CE 2211 .3: Design the various biological treatment of wastewater

CE 2211.4: Design the sludge disposal methods

CE 2211.5: Illustrate the various tertiary treatments in wastewater treatment.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2211.1	1	1	-	-	-
CE 2211.2	1	-	1	-	-
CE 2211.3	2	1	1	-	1
CE 2211.4	2	2	-	1	1
CE 2211.5	2	2	-	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE 2212							Course category		PC
Course Name	INDUSTRIAL WASTEWATER TREATMENT									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To study the effects of discharge of Industrial Wastewater on the environment
2. To study to minimize the problems of Industrial Wastewater
3. To study the characteristics and treatments of Industrial Wastewaters from different industries.

Course Contents:

Problem of Industrial Waste Water:

Variation in quality and quantity of industrial wastewater, Effects of discharge of industrial waste water on streams; land and municipal sewers. Benefits of water pollution control by doing treatment of industrial waste.

Indian Standards for discharge of treated wastewater on land, into municipal sewer and natural water courses.

Sampling Procedure:

Industrial waste survey; Stream sanitation, Stream sampling, Types of sampling, Stream survey, Sampling analysis

Approaches to Minimization of problem of industrial waste water, Good housekeeping, equalization, neutralization, precipitation, mixing of different effluent streams, recycle of effluent streams, process modifications in terms of raw materials or chemicals used general approach to planning of industrial waste water treatment and disposal, Cleaner Technologies of production for waste minimization.

Different Aspects and choices of various alternatives such as, Treating different effluent streams separately, Treating different streams jointly after mixing them partly or fully, Including/excluding domestic waste along with the industrial waste.

General Approach for handling and treatment of industrial wastewater with following special characteristics

Shock Loads, presence of colours, toxic metal/ions, refractory substances, e.g. A B S and other

detergents, growth inhibiting substances such as insecticides, waste rich in nutrients (N.P.K. etc.), waste rich in oil & grease, high suspended solids, high BOD, high temperature, acidity, alkalinity etc.

Experimental Evaluation of physico-chemical or biological treatment processes for treatment of the waste water.

Process Line Diagrams, characteristics and treatment of industrial waste of: - Pulp and paper, textile, tannery, food, Cannings, sugar mill, distillery, dairy, pharmaceutical, electroplating etc. industries. Design of Effluent Treatment Plant

Advanced industrial wastewater treatment: Principles of tertiary treatment, Reuse and resource recovery. recent trends in industrial waste management, Cleaner technologies.

Reference Books

1. Waste Water Treatment, Disposal and Reuse, Mctcalf and Eddy, Tata McGraw Hill Publishing Co. Ltd, 1995
2. Pollution Control in Process Industries, S. P. Mahajan, Tata McGraw-Hill, 1985.
3. Liquid Waste of Industry – Theory, Practices and Treatment, Nemcrow, Addison- Wesley, 1971.
4. Industrial Water Pollution Control, W.W. Eckenfelder, McGraw-Hill, 1989.
5. Natural Systems for Waste Management and Treatment, S.C. Reed, E.J.
6. Middlebrooks and R.W. Crites, McGraw-Hill, 1988.
7. Biological Treatment of Waste Waters: W.W. Eckenfelder, Pergamon Press,1961.

Course Outcomes:

After successful completion of the course, students will be able to

CE2212.1: Identify the effects of discharge of Industrial Wastewater on land and water bodies

CE2212.2: Apply the knowledge to minimize the problems of Industrial Wastewaters

CE2212.3: Apply the knowledge for effective and sustainable treatments of Industrial Wastewaters from different industries

CE2212.4: Illustrate the various tertiary treatments in wastewater treatment.

CE2212.5: Design ETP for different industries

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2212.1	1	1	-	-	-
CE 2212.2	1	-	1	-	-
CE 2212.3	2	1	1	-	1
CE 2212.4	2	2	-	1	-
CE 2212.5	2	2	-	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE 2213							Course category		PC
Course Name	AIR QUALITY MONITORING AND CONTROL									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To Expose Students to the concepts of various spheres, Air pollution, Sources of pollutants and effects on vegetation, materials and Humans
2. To study about Meteorology, Solar radiation, Heat balance, greenhouse effect, Wind velocity, wind rose, turbulence, wind profile, Atmospheric Stability, Lapse rate, inversion, flume shape and transport of air pollutants
3. To learn and understand Ambient air quality, Air Pollution Monitoring, monitoring equipments, stack monitoring and source monitoring, air pollution control devices, various methods of control of particulate matter in industries .
4. To study in detail about design of emission control devices and control of gaseous emission.
5. To learn and understand Air Quality Modelling and various air quality mathematical models.
6. To make students aware about pollution from mobile sources and Other Types of Pollutions, Noise pollution, Radioactive pollution, Thermal pollution.**General Principles**, Biosphere, Air Environment, Air pollution, Primary and Secondary pollutants, Removal processes, sources of pollution, Averaging time air quality.

Course Contents:

Particulate Matter:

Natural & manmade, viable & nonviable, effects & removal mechanism, particle size distribution

Gaseous Pollutants:

CO, CO2, Ozone, SO2, H2S, Sources and effects on vegetation materials and Humans, photo-chemical smog, secondary pollutants : NOx, Atmospheric reactions & Scavenging process

Meteorology: Solar radiation, Heat balance, greenhouse effect, Wind velocity, wind rose, turbulence, wind profile, humidity, temperature

Member Secretary BoS Chairperson Dean (Academics) Principal

Atmospheric Stability:

Lapse rate, inversion : flume shape, Max mixing depth. Transport of air pollutants

Air Pollution Monitoring:

Sampling, monitoring equipments, stack monitoring, quality surveillance, source monitoring, Ambient air quality.

Air Pollution Control:

Various methods of control of particulate matter in industries and design of gravity separator, cyclone separator, filters, electrostatic preceptor, absorption devices, scrubbers, combustion devices, control of gaseous emission and process emission controls.

Air Quality Modeling:

Modeling, Air quality mathematical models, Gaussian Dispersion model, plume rise, application of models.

Pollution from mobile sources, problems, effects, testing and control, preventive measures.

Other Types of Pollutions:

Noise pollution, Radioactive pollution, Thermal pollution, Nature, sources, effects and control measures.

Reference Books

1. Air Pollution, Vol. I to IV, A. C. Stern, Academic, New York, 1968.Fundamentals of Air Pollution, Stern, Wohlers, Bouble and Lower, Academic Press, 1984.
2. Air Pollution and Control, P. P. Mowli and N. Venkata Subbayya., Divyajyoti Prakashan, Jodhpur, 1989.
3. Air Pollution, Rao & Rao., Tata McGraw Hill,2006.
4. Air Quality Monitoring- A Course Manual, NEERI, 1981.

Course Outcomes:

On successful Completion of the course, students will able to:

CE2213.1: Gain a broad understanding of Air Environment, Air pollution, Gaseous Pollutants, Sources of pollutants and effects on vegetation, materials and Humans

CE2213.2: Study the Ambient air quality, Air Pollution Monitoring, Monitoring equipments, air pollution control devices.

CE2213.3: Study the various air quality mathematical models.

CE2213.4: Comprehend the Air Quality Modeling and Other Types of Pollutions:

CE2213.5: Design of emission control devices and control of gaseous emission

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE 2213.1	1	1	-	-	-
CE 2213.2	1	-	1	-	-
CE 2213.3	2	1	1	-	1
CE 2213.4	2	2	-	1	1
CE 2213.5	2	2	-	1	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE 2214 (A)							Course category			PE
Course Name	ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To understand the importance Environmental Impact Assessments
2. To study the various EIA methodologies
3. To learn the preparation of EIA reports
4. To learn the various Environmental management techniques.

Course Contents:

Evolution of EIA;

EIA at project; Regional and policy levels; Strategic EIA; EIA process; Screening and scoping criteria

Rapid and comprehensive EIA;

Specialized areas like environmental health impact assessment; Environmental risk analysis;

Economic valuation methods;

Cost-benefit analysis; Expert system and GIS applications; Uncertainties

Legislative and environmental clearance procedures in India and other countries, Siting criteria; CRZ;

Public participation; Resettlement and rehabilitation, Practical applications of EIA;

EIA methodologies;

Baseline data collection; Prediction and assessment of impacts on physical, biological and socio-economic environment; Environmental management plan; **Post project monitoring**

EIA report and EIS; Review process:

Case studies on project, regional and sectorial EIA.

Life Cycle Assessment (LCA):

Life cycle assessment and its purpose, Evolution of Life Cycle Assessment, Stages in LCA of a Product,

A Code of Good Conduct for LCA, Procedures for LCA, Defining the goal and scope, Analyzing the inventory, Assessing environmental impact, Evaluating environmental profiles, Different Applications of LCA, Private sector applications, Governmental application

Environmental Management Techniques:

Environmental Monitoring, Environmental Modeling, Forecasting modeling, Growth modeling, Sensitivity Analysis, Application of Remote Sensing and GIS in EM, Environmental Profile, Environmental Technology Assessment, Environmental Risk Assessment, Environmental risk management in industries, Ecosystem approach to risk assessment, Rapid Urban Environmental Assessment, Eco-mapping, Environmental Education

Case Study of Environmental Impact Assessment on any project nearby the town

Reference Books

1. Environmental Impact Assessment: Rau and Woofer
2. Environmental Impact Assessment: W.F. Canter, McGraw Hill, 1977.
3. Proceedings of Indo-British Workshop on EIA of Petrochemical Industries and Environmental Audit, Jan. 1994, IAEM, Nagpur.
4. Handbook on Pollution Control Acts, Central Pollution Control Board, New Delhi.
5. The New Environmental Age, R.K. Sapra, S. Bhardwaj, Ashish Pub. House, New Delhi.,1990CEP 244 (B) ENVIRONMENTAL MANAGEMENT AND AUDITING

Course Outcomes

On successful Completion of the course, students will be able to:

CE 2214(A).1: Explain the necessity of Environmental Impact Assessments

CE 2214(A).2: Illustrate the various EIA methodologies

CE 2214(A).3: Collect data and prepare EIA reports

CE 2214(A).4: Explain Life cycle assessment

CE 2214(A).5: Illustrate various Environmental management techniques.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE2214(A).1	1	2	-	-	-
CE2214(A).2	-	1	2	1	-
CE2214(A).3	-	2	1	-	-
CE2214(A).4	1	1	-	1	1
CE2214(A).5	1	2	3	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE 2214 (B)							Course category		PE
Course Name	ENVIRONMENTAL MANAGEMENT AND AUDITING									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To study the Principles of Environment Management
2. To study the Policies and Legal Aspects of EM
3. To study Environmental Auditing
4. To study Environmental Management System Standards

Course Contents:

Principles of Environment Management:

Introducing Environmental Management (EM), Definition and scope, Goals of EM, Need for EM, Need for sustainable development, EM tools, Participants in EM, Existing users, Groups seeking change, Groups with little control, The public, Facilitators, Controllers,

Ethics and the Environment:

The philosophy of Aldo Leopold, Factors that necessitate environmental ethics, International Environmental Movement, Environmental Concerns in India

Policy and Legal Aspects of EM:

Introduction to Environmental Policies, Economics and environmental policies, Industries and environmental policies, Agriculture and environmental policies, Ecosystem and environmental policies, Environmental policy instruments (EPI), Environmental Policies and Programmes in India, Forest conservation activities, NGO movements for environmental protection in India, Environmental Laws and Legislations, Private and Public law, Principles of international law, Indian Environmental Laws, International institutions, Key international treaties, objectives and principles of legislation, Environmental Legislations in India, Evolution of Indian Legislations, Constitution of India, Union Government initiatives

Environmental Auditing:

Introduction to Environmental Auditing (EA), Principles of auditing objectives and scope,

Responsibilities, resources and procedures within the audit records from the audit program, monitoring and reviewing the audit program, Types of environmental audits, General Audit Methodology, Basic structure of EA, General steps in EA procedure, Elements of Audit Process, What to audit, Who should audit, Why an audit, How to audit, Waste Audits and Pollution Prevention Assessments, EA in Industrial Projects, Liability Audits and Site Assessment, Auditing of EMS, Audit objectives roles and responsibilities, Scoping and review, Preparing the audit(start, setting objectives scope and audit criteria, determining the feasibility audit, selection of the audit team to establish initial contact with the audited organization, document review, preparation of the audit on the spot), Implementation of on-site audit, Preparation, approval and distribution of messages, Resolution of disagreements, corrective and preventive actions, competence and evaluation of auditors, Conducting the audit, Content of audit report

Life Cycle Assessment (LCA):

Life cycle assessment and its purpose, Evolution of Life Cycle Assessment, Stages in LCA of a Product, A Code of Good Conduct for LCA, Procedures for LCA, Defining the goal and scope, Analyzing the inventory, Assessing environmental impact, Evaluating environmental profiles, Different Applications of LCA, Private sector applications, Governmental application

Environmental Management System Standards:

Environmental Management Systems (EMS), Core elements of EMS, Benefits of EMS, Certification body assessments of EMS, Documentation for EMS, EMS Standards: ISO 14000-Evolution, Principles and structure, ISO 14000 supporting systems, EMS specification standards: ISO 14001, Implementation of EMS Conforming to ISO 14001, Benefits of Implementing ISO 14001: An Indian Scenario, OHSAS 18001 and its comparison with ISO 14001 and ISO 9001, BS 18004:2008

Reference Books

1. Environmental Science and Management, Abhijit Mallick,
2. The ISO 14000 EMS Audit Handbook, Greg Johnson
3. Corporate Environmental Management Systems and Strategies, Richard Welford, Universities Press (I) Ltd., Hyderabad, 1996.

Course Outcomes:

After successful completion of the course, students will be able to:

CE2214 (B) .1 Understand the Principles of Environment Management

CE2214 (B) .2: Apply the knowledge of various environmental policies and laws

CE2214 (B).3: Carry out Environmental Auditing

CE2214 (B).4: Apply knowledge of Various EMS specification standards

CE 2214(B).5: Prepare the documentation of Environmental Management System

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE2214(B).1	1	2	-	-	-
CE2214(B).2	-	1	2	1	-
CE2214(B).3	-	1	3	-	-
CE2214(B).4	1	1	-	1	1
CE2214(B).5	1	1	2	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Member Secretary BoS Chairperson Dean (Academics) Principal

Course Code	CE 2214 (C)							Course category			PE
Course Name	ENVIRONMENTAL STATISTICS AND OPTIMIZATION TECHNIQUES										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To understand and determine parameters of sampling theory.
2. To understand and determine confidence intervals for parameters of estimation theory.
3. To learn techniques to take statistical decisions using test of hypothesis for a given sample.
4. To learn techniques to formulate and solve linear as well as nonlinear optimization problems.

Course Contents:

Sampling Theory:

Population Parameter, Sample Statistics, Sampling distributions, Sample mean, Sampling distribution of means, the sample variance, the sampling distribution of variance.

Estimation Theory:

Point estimate and interval estimates reliability, confidence interval estimates of population parameters, confidence intervals for means, proportions and variance.

Tests of Hypothesis and Significance:

Statistical decisions, tests of hypotheses and significance, Type I and Type II errors, level of significance, one tailed and two tailed tests, Tests involving small samples and large samples, fitting theoretical distributions to sample frequency distribution, The chi-square test for goodness of fit.

O. R. Techniques

Linear Programming: Formulation of linear programming problem, Graphical solution- simplex method (including Big M method and two phase method), dual problem- duality theory, dual simplex method, revised simplex method.

Transportation problem: Existence of solution-degeneracy- MODI method; Assignment problem-traveling salesman problem

Nonlinear programming problem (NLPP): Constrained NLPP, Lagrange"s multipliers method – convex NLPP, Kuhn-Tucker conditions

Reference Books

1. Environmental Statistics and Data Analysis, Wayne R. Ott, CRC Press, 1994
2. Environmental statistics: Methods and Applications, V Barnett, John Wiley & Sons Ltd, 2004
3. Environmental Statistics with S-Plus, Steven P. Millard, Nagaraj K. and Neerchal,CRC Press 2001
4. Probability and Statistics, M.R. Speigel, McGraw Hill,
5. Operation Research, H.A. Taha, Prentice Hall of India Pvt. Ltd.
6. Introduction to Optimisation: Operations Research, J.C. Pant,Jain Brothers, New Delhi. Probability and Statistics for Engineers, Miller and Freund,

Course Outcomes:

On successful Completion of the course, students will able to:

CE2214 (C).1: Determine parameters of sampling theory.

CE2214 (C).2: Determine confidence intervals for parameters of estimation theory.

CE2214 (C).3: To take statistical decisions using test of hypothesis for a given sample.

CE 2214 (C).4: Study the various O.R Techniques

CE2214 (C).5: Formulate and solve linear as well as nonlinear optimization problems.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE2214(C).1	1	2	1	-	-
CE2214(C).2	2	1	-	-	-
CE2214(C).3	1	-	1	1	1
CE2214(C).4	2	-	-	1	1
CE2214(C).5	1	1	1	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

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Course Code	CE 2214 (D)			PE				ESA
Course Name	BIREMEDIATION: PRINCIPLES AND APPLICATIONS							
Teaching Scheme				Examination Scheme				Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. To understand the importance of biotransformation, biodegradation, bioremediation and Bio remedial practices.
2. To learn the various impacts of bio remedial practices, bio stimulation, bio augmentation, bio concentration and bio magnifications.
3. To learn the various aspects of Natural and programmed bioremediation, anaerobic and aerobic bioremediation processes, application of bioinformatics in bioremediation.
4. To study Genetic Engineering, bioremediation, Concept and types of phytoremediation systems.
5. To study biosensors and their applications in bioremediation.

Course Contents:

Introduction to biotransformation:

Biodegradation and bioremediation, history of bioremediation, xenobiotics and their structures and persistence in the environment, in situ and ex situ bioremediation technologies and their merits and demerits.

Bio remedial practices:

An overview of the current bio remedial practices and its application, factors affecting bioremediation (physical, chemical and biological), bio stimulation and bio augmentation, bio concentration and bio magnifications.

Natural and programmed bioremediation:

Inducible and degrading enzymes and their roles, Roles of electron donors and acceptors in bioremediation, anaerobic and aerobic bioremediation processes, application of bioinformatics in bioremediation

Types of bioremediation:

Solid and slurry phase bioremediation (composting, land farming, slurry bioreactors and lagoons), liquid phase bioremediation, bioventing, soil-vapour extraction(SVE) and treatment.

Genetic Engineering and bioremediation

Phytoremediation: Concept of phytoremediation, roles of phytochelatins and chemicals secreted by the plant roots, phytoremediation with trangemic plants, fungal and algal bioremediation, merits and demerits of phytoremediation, Types of phytoremediation systems.

Regulations of GM organisms in India

Biosensors and their applications in bioremediation

Reference Books

1. Baker H. and Herson D.S. Bioremediation, McGraw Hill, 1994
2. Eweis J.B., Ergas S.J., Chang D.P.Y. and Schroeder E.D., Bioremediation Principles, McGraw Hill, 1998.SHP 221

Course Outcomes:

On successful Completion of the course, students will able to

CE2214 (D).1: Illustrate importance of biotransformation, biodegradation and bioremediation.

CE2214 (D).2: Explain the impacts of bio remedial practices, bio stimulation

CE2214 (D).3: Know various aspects of Natural and programmed bioremediation, anaerobicand aerobic bioremediation processes, application of bioinformatics in bioremediation.

CE2214 (D).4: Know Genetic Engineering, bioremediation, Concept and types of phytoremediation

CE2214 (D).5: Study application of biosensors in bioremediation.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE2214(D).1	2	1	1	-	-
CE2214(D).2	2	1	-	-	-
CE2214(D).3	1	1	1	1	-
CE2214(D).4	1	2	1	-	1
CE2214(D).5	-	1	1	1	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	SH 2201							Course category		RM
Course Name	RESEARCH METHODOLOGY									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	30	10	60	2 hrs 30 min	-	-	100	03

Course Objectives:

1. Understand research problem formulation.
2. Analyze research related information
3. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
4. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Course Contents:

Introduction to Research:
Definition of research, Characteristics of research, Types of research- Descriptive *vs.* Analytical, Applied *vs.* Fundamental, Quantitative *vs.* Qualitative, Conceptual *vs.* Empirical, Steps of research methodology

Research Problem Formulation and Methods:
Literature review, sources of literature, various referencing procedures, maintain literature data using Endnote2, Identifying the research areas from the literature review and research database, Problem Formulation, Identifying variables to be studied, determining the scope, objectives, limitations and or assumptions of the identified research problem, Justify basis for assumption, Formulate time plan for achieving targeted problem solution. Important steps in research methods: Observation and Facts, Laws and Theories, Development of Models. Developing a research plan: Exploration, Description, Diagnosis and Experimentation

Data collection:
Sampling methods, methods of data collection, Basic Concepts concerning testing of hypotheses, procedures

of hypothesis testing, generalization and interpretation Applied statistics: Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis Software tools for modeling, Simulation and analysis.

Research reports and Thesis writing:

Introduction: Structure and components of scientific reports, types of report, Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

Research Ethics, IPR and Publishing: Ethics: Ethical issues.

IPR: intellectual property rights and patent law:

Techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights,

Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Reference Books:

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications Ltd., 2011.
2. Wayne Goddard, Stuart Melville, "Research Methodology: An Introduction" JUTA and Company Ltd, 2004.
3. C.R. Kothari ,"Research Methodology: Methods and Trends", New Age International,2004
4. S.D. Sharma , "Operational Research", Kedar Nath Ram Nath & Co.,1972
5. B.L. Wadehra, "Law Relating to Patents, Trademarks, Copyright Designs and

Course Outcomes:

At the end of this course, students will be able to :

SH 2201.1 Understand research problem formulation.

SH 2201.2 Analyze research related information.

SH 2201.3 Follow research ethics

SH 2201.4 Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

SH 2201.5 Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
SH2201.1	1	2	1	-	-
SH2201.2	2	-	1	1	-
SH2201.3	1	2	-	-	1
SH2201.4	1	1	1	-	-
SH2201.5	-	-	1	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

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Course Code	CE2215	Course category	PC
Course Name	ENVIRONMENTAL ENGINEERING LABORATORY II		

Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
-	-	06	06	-	-	-	-	50	50	100	03

Course Objectives:

1. To design various units of STP and ETP using software
2. To study the characteristics and treatments of Industrial Wastewaters from different industries
3. To Study various instruments & Equipment required for Air Quality Monitoring
4. To perform Air Quality Monitoring .and perform Statistical Analysis of observed air pollution data
5. To design Air Quality monitoring Equipment
6. Design Problems/ Laboratory Practical based on curriculum Related with the subjects CEP 211, CEP 212, CEP 213 and CEP 214 :

Part A:

Design Problems based on curriculum Related with CEP 211 Advanced Wastewater Treatment

1. Design of Sewage treatment plant / Effluent treatment plant using Excel / Programming in any Language / Software
2. Report based on field visit to ETP

Part B:

Design Problems based on curriculum Related with CEP 212 Industrial Wastewater Treatment

Part C:Laboratory Practical based on curriculum Related with CEP 213

1. Study of Air Quality Monitoring Instruments & Equipment.
2. Determination of wind velocity, wind direction, temperature, cloud cover, humidity & preparation of wind-rose diagram.
3. Determination of SPM, RSPM, SOx, NOx
4. Determination of CO % & NO % of the exhaust gases from vehicles or gasoline engine.
5. Statistical Analysis of observed air pollution data.

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6. Design of Bag filter for controlling dust pollution in particular industry – A case study.
7. Design of cyclone separator.

Course Outcomes:

After successful completion of the course, students will be able to:

CE 2215.1: Design STP and ETP using various software

CE 2215.2.: Apply the knowledge for effective and sustainable treatments of Industrial Wastewaters from different industries

CE 2215.3.: Carry out Air Quality monitoring for various parameters

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE2215.1	1	1	-	1	-
CE2215.2	1	2	2	-	1
CE2215.3	1	-	1	2	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CE2216							Course category			ICC
Course Name	SEMINAR II										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
-	-	01	01	-	-	-	-	50	-	50	02

Course Objectives:

1. To know the state of the art in the relevant subjects of Environmental Engineering.
2. To carry out extensive literature survey and identify the research gap.
3. To present literature review report with comparison of results of previous research work.

Student has to select a topic for Seminar in consultation with the allotted guide, carry out literature review, submit the seminar Report and deliver the seminar based on it. The topic for seminar should be related to the literature survey based on Dissertation topic. It is to be evaluated internally by three member panel of examiners wherein guide should be one of the members of the panel.

Course Outcomes:

On successful Completion of the course, students will be able to:

CE2216.1: Conduct extensive literature survey in subjects of Environmental Engineering.

CE2216.2: Decide approach to apply experimental or mathematical skill to validate theories to relevant subject

CE2216.3: Prepare and present the report with interpretation and bridging the research gap

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CE2216.1	1	1	-	1	-
CE2216.2	1	-	1	-	-
CE2216.3	1	-	1	2	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

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Course Code								CATEGORY			OJT/FP
Course Name	ON JOB TRAINING / FIELD PRACTICE										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
-	-	-	-	-	-	-	-	50	-	50	04

Students must complete On-the-job training/ Internship/ Field work for a duration of minimum four weeks during summer break, after completion of second semester of first year in the respective major subject. The company/ organization for On-job training/ Internship/ Field work must be approved by the DFB.

The student must submit the report of On-job training / Internship / Field Work , in the format prescribed by the Institute.

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