Semester- II

Water Treatment Technology			
Course Code	**MCWH201**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:02:00	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory +10-12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course Learning objectives:

This course will enable students to;

- Gain the Knowledge on significance of water quality and standards for usage.
- Understand the objectives of water treatment.
- Understand the Design and operation of Water Treatment Process.
- Understand about the Purification process like, Sedimentation, Coagulation,
- Filtration, Disinfection, Fluoridation & De-fluoridation and softening methodologies involved before supplying to Public.

Teaching-Learning Process	Class room

Module-1

Introduction: Objectives for Treatment of water, Water pollution, Sources of water pollution and control methods. Point and non-point sources of water pollution. Difference between Ground water and Surface water Quality. Water Borne and Water induced diseases and their control.

Quality of Water and Analysis: Drinking water quality standards as per BIS & WHO guide lines. Importance of Bacteriological examination of water, Plate Count Test and MPN Test. Problems on determination of E-coli using MPN equations.

Teaching-Learning Process	Class room

Module-2

Water Treatment System: Flow Diagram on overall water supply Engg. Project. Various types of Unit flow diagrams used on Water Treatment System. Water Intake Structures and their classifications.

Purification of water: Aeration process-Importance and limitations. Gas Transfer two film model: Water in Air system and Air in Water system with their types. Significance of Dissolved Oxygen in Water. Principles and theory of Sedimentation Process and Solids Separation. Design of Sedimentation tank (Circular and Rectangular) in the removal of Discrete particles.

Teaching-Learning Process	Class room

Module-3

Coagulation and Flocculation: Coagulation and Flocculation process of water. Theory of Coagulation and Principle. Types of Coagulants used with their merits and demerits. Chemical reaction with Coagulants and water, Chemical feeding system. Determination of Optimum Coagulant Dosage using Flocculator. Numerical problems on estimation of Coagulants.

Teaching-Learning Process	Class room

Module-4
Water Filtration Techniques– Principles and theory of Filtration. Sand filters used in treatment of water and Classifications. Operational troubles and troubleshooting methods used for SSF and RSF in treatment of water. Design criteria used and Design of Slow and Rapid Sand Filters required for water treatment.

Teaching-Learning Process	Class room

Module-5
Water Disinfection: Sterilization and Disinfection. Methods of Disinfection and their suitability. Theory of Disinfection, characteristics of a good Disinfectant. Forms of Chlorination, Chemical reactions, Break point Chlorination. Determination of Chlorine Demand of water. Estimation of Chlorine and quantity of Bleaching powder requirement in treatment of water. **Miscellaneous Treatment of water:** Hardness of water and its significance. Numerical used on determination of Hardness in water. Water softening methods. Fluoridation and De-fluoridation techniques.
PRACTICAL COMPONENT OF IPCC: • Determination of Optimum Coagulant Dosage. • Determination of Dissolved Oxygen. • Determination of BOD. • Determination of solids from wastewater samples. • Determination of Percentage 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. 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

CIE for the theory component of IPCC
1.•Two Tests each of 25 Marks

2.•Two assignments each of 25 Marks/One Skill Development Activity of 50 marks
3.•Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to 30 marks.

CIE for the practical component of IPCC
••On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.
••The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
••The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks.
Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.
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SEE for IPCC
Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours)
1.•The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2.•The question paper will have ten questions. Each question is set for 20 marks.
3.•There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
4.•The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).
••The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course (CIE+SEE)
1

Suggested Learning Resources:

Books:

1. Fair, G.M., Geyer J.C and Okun, (1969), **Water supply Engineering** Vol- I, John Wiley Publications.

2. Weber W.J., (1975) **Physico - Chemical Processes for Water Quality Control**.

3. CPHEEO Manual, (2003), **Water Supply and Treatment Engineering,** GOI- Publications, New Delhi

Web links and Video Lectures (e-Resources):

- https://youtu.be/KMP9-49I1U4.

Skill Development Activities Suggested

- Visiting to nearby Water treatment plant.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand the importance of drinking water quality.	1,2
CO2	Understand the Unit treatment process of water.	1,2,3,4
CO3	Know the Objectives and importance of treatment process of water by physico- chemical process.	1,2,3,4
CO4	Understand the Water filtration techniques and types	1,2,3,4
CO5	Gain the knowledge on water disinfection and softening process techniques.	1,2,3,4

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Suggested Learning Resources:

Reference Books:

1. Odum E.P. & Barret G.W., (2005), "**Fundamentals of Ecology**", 5thEdition, Cengage Learning.

2. Schnoor J.L., "**Environmental Modelling – Fate and Transport of Pollutants in Water, Air and Soil**".

3. John Wiley and Sons, Thomann R.V. and Mueller J.A., "**Principles of Water Quality Management and Control**", Harper & Row Publications.

Web links and Video Lectures (e-Resources):

- https://youtu.be/KMP9-49I1U4.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning.

- Visiting to nearby Water treatment plant.

Semester-II

Integrated Solid Waste Management			
Course Code	**MCWH202**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	3	Exam Hours	03

Course Learning objectives:

- Gain knowledge on collection, transfer, and transport of municipal solid waste.
- Understand the methods on processing and operation of solid waste under land filling process.
- Understand the strategies for collecting the recyclable materials and resource recovery.
- Understand the methods of solid waste disposal techniques.
  Understand the recent developments on solid waste management.

Module-1

Introduction: Solid waste management, Classification of solid waste, sources, properties of solid waste. Estimation of moisture content and density of a solid waste, materials flow in society, functional elements and impact of solid waste management.

System for solid waste management: Solid waste generation, factors affecting generation rates, on site storage collection services, Modes of collection system, collection routes, Transfer stations.

Module-2

Processing Techniques: Processing methodologies and waste minimization, Mechanical Size reduction, Volume reduction, Density separation.

Land Filling: Factors considered in selection of site for landfill, Sanitary Landfilling, Land filling methods and operations, occurrence of gases and Leachate in Landfills control of leachate movement. Control of gas movement.

Module-3

Treatment Methodologies: Composting- Aerobic and Anerobic process, Factors affecting composting process, Vermicomposting process. Incineration, Pyrolysis and Energy recovery.

Thermal Treatment: Incineration and Types, 3T's Concept. Pyrolysis, Energy recovery concept and methods.

Module-4

Hazardous waste: Introduction, Identification of Hazardous waste from solid waste, Classification, Treatment and Disposal techniques.

Refuse Disposal: Methods of Disposal, Significance of refuse disposal and management, Environmental impact of open land dumping. 3R concept in solid waste disposal.

Module-5

Bio-medical waste Management: Introduction, sources and generation of bio-medical waste. Bio-medical waste management.

E-Waste Management: Introduction, E-waste Sources, Health and Environmental Effects.

Plastic waste Management: Environmental Impact of plastic waste, Recycling of plastic waste and Disposal Methods.

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 **one Skill 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

4. Tchobanoglous G., Theissen H., and EIiassenR.(1991), **"Solid Waste Engineering Principles and Management Issues**",McGraw Hill, NewYork.
5. Peavy, Rowe and Tchobanoglous (1985), "**Environmental Engineering**",McGraw Hill Co. 4th Edition.
6. CPHEEO, Manual on **Municipal Solid waste management**, Central Public Healthnd Environmental Engineering Organisation, Government of India, New Delhi, 2000.
7. K. Shashi Kumar, **Solid waste management,** PHI Publications.

Web links and Video Lectures (e-Resources):

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Skill Development Activities Suggested

- Visit to solid waste Land filling site.
- Visit to Vermi composting Units.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Apply the basic principles behind solid waste management, for solving practical problems.	1,2,3,
CO2	To know the roll and importance of solid waste management in a society.	1,2,3,
CO3	Know the methods required for the treatment of waste and recovery of materials.	1,2,3
CO4	To understand the recent developments on solid waste management and its importance.	1,2,3

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering Knowledge	**PO1**
2	Problem Analysis	**PO2**
3	Design / Development Solutions	**PO3**
4	Conduct Investigations of Complex problems	**PO4**
5	Modern tool usage	**PO5**
6	Engineer and Society	**PO6**
7	Environment and Sustainability	**PO7**
8	Ethics	**PO8**
9	Individual and Team-Work	**PO9**
10	Communication	**PO10**
11	Project Management and Finance	**PO11**
12	Life-long Learning	**PO12**

Mapping of COS and POs

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

Semester- II

Municipal and Industrial Waste Water Treatment System			
Course Code	**MCWH203**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

This course will enable students to;

- To understand the basic characteristics of wastewater.
- Understanding the kinetics of biological system.
- Understand the design and working principle of various treatment methods.

Understand magnitude and influence of hazardous content.

Module-1

Introduction: Objectives of wastewater treatment system, need for sanitation, classification of sewerage systems. Factors affecting DWF & WWF, Estimation of Dry and Wet weather flow.

Design of sewers: Characteristics & sampling techniques of municipal wastewater, BOD & COD - methods of determination. hydraulic formula used for velocity, design of hydraulic elements for circular sewers for full flow and partial flow conditions.

Module-2

Treatment of Municipal wastewater: Flow chart of Municipal waste water treatment system, Screenings, Grit chamber, Oil and Grease removal, CNS cycles.

Low cost wastewater treatment methods: Septic tank, Oxidation Pond and Oxidation Ditches. Reuse and recycle of wastewater.

Module-3

Wastewater Treatment: Aerobic and Anaerobic treatment methods. Suspended growth system: Conventional activated sludge process and its modifications. Attached growth system,: Trickling filters and Rotating Biological contactors. Sludge disposal methods.

Disposal of Effluents: Self purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents, Streeter-Phelps equation.

Module-4

Industrial Waste water: Difference between domestic and industrial waste water, Effect of effluent discharge on streams.

Methods of industrial wastewater treatment; Volume reduction, Strength reduction, Neutralization, Equalization and Proportioning. Removal of organic, inorganic and colloidal solids, combined treatment methods; merits, demerits and feasibility, principles of discharge of wastes in to streams.

Module-5

Industries of Treatment: Industrial Process & treatment flow chart, Sources and characteristics of: Cotton and Textile industry, Tanning industry, Cane sugar, Distilleries, Dairy industry, Paper and Pulp industry, Food processing industry.

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:

3. Two Unit Tests each of **25 Marks**
4. Two assignments each of **25 Marks** or **one Skill 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:

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

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Suggested Learning Resources:

Books

8. Wastewater Engineering - Treatment and Reuse", Metcalf and Eddy Inc., (2003), 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
9. Wastewater Treatment Concepts and Design Approach, Karia G.L., andChristian R.A., (2001), Prentice Hall of India Pvt. Ltd., New Delhi.

Web links and Video Lectures (e-Resources):

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Skill Development Activities Suggested

- Visiting to Sewage Treatment Plant nearby.
- Visiting to an Industrial process nearby.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Know the concept sanitation along with designs of sewers.	1,2,3
CO2	know the basic characteristics of wastewater and the kinetics of biological system.	1,2,3,4
CO3	Understand the design and working principle of various treatment methods.	1,2,3,4
CO4	Understand the attributes which deals with industrial and municipal wastewater.	1,2,3,4
CO5	Understand the unit manufacturing process involved in the various industries	1,2,3,4

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	PO1
2.	Problem Analysis	PO2
3.	Design / Development Solutions	PO3
4.	Conduct Investigations of Complex problems	PO4
5.	Modern tool usage	PO5
6.	Engineer and Society	PO6
7.	Environment and Sustainability	PO7
8.	Ethics	PO8
9.	Individual and Team-Work	PO9
10.	Communication	PO10
11.	Project Management and Finance	PO11
12.	Life-long Learning	PO12

Mapping of COS and POs

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

Semester- II

Environmental Chemistry and Microbiology			
Course Code	MCWH204	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	3	Exam Hours	03

Course Learning objectives:
Students can able to understand;

- The course introduces both Water Chemistry and aquatic systems for students.
- It explains different ecosystems and their interactions through symbiotic and synergic relationships, reviews ecological indices and modes.
- It describes tropic levels of lakes, influence of nutrient loading and control measures for Eutrophication.
- Know the Importance of modelling in wastewater engineering.

Module-1

Atmospheric Chemistry- Environmental Segments; Lithosphere, Hydrosphere, Biosphere and Atmosphere. Composition of Atmospheric air, radiation balance of earth, Chemical species and particulates present in atmosphere, photochemical reactions in atmosphere (ozone, nitrogen and Sulphur).

Global warming: Greenhouse concept and its environmental effects, Impacts of Global warming and ozone depletion. Effects of air pollutants on health and property issues. Absorption and adsorption techniques used for the control of gaseous pollutants.

Module-2

Water Chemistry; Water resources and classification of water pollutants. Physico-chemical and Biological characteristics of water and wastewater. Significance of bacteriological test in water quality. Water quality standards.

Hydrology; Hydrological cycle (Hortons cycle), Global water distribution, Rain water harvesting methods and recharging of ground water.

Module-3

Soil Chemistry; Layers of Earth, Types of rocks, Formation of soil, Composition of soil and weathering process, Types of soil textures, Accumulation of salts in soil.
Soil Pollution; Sources of soil pollution, Effects of soil pollutants, Control measures of soil pollution, Agricultural and urban waste on soil. Marine pollution, sources, effects and control of marine pollution.

Module-4

Chemistry for Wastewater; Concept of coagulation, Coagulants determination of optimum dosage. Types of Oxygen demands and importance of dissolved oxygen in water and wastewater. Methods of determination of BOD and COD.
Organic and Inorganic Wates; Sources of Organic and Inorganic wastes, Characteristics, various types of Organic and Inorganic wastes from industries. Total Solids and their determination from water and wastewater.

Module-5

Eutrophication; Eutrophication process. Effects of eutrophication, Oligotrophic and eutrophic water bodies, various sources of nutrients-natural and manmade sources causing eutrophication, Preventive measures.
Pesticidal pollution; Introduction, types of pesticides and persistence of pesticides in soil and water. Pesticides kinetics in environment. Pesticidal impacts on environment.

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:

5. Two Unit Tests each of **25 Marks**
6. Two assignments each of **25 Marks** or **one Skill 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:

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

.

Suggested Learning Resources:

Books:

10. John Wiley and Sons. Thomann R.V., and Mueller J.A., "**Principles of Water Quality Management and Control**", Harper & Row Publications.

11. Schnoor J.L., "**Environmental Modelling –** Fate and Transport of Pollutants in Water, Air and Soil".

12. Odum E.P. & Barret G.W., (2005), "**Fundamentals of Ecology**", 5thEdition, Cengage Learning.

Web links and Video Lectures (e-Resources):

- .

Skill Development Activities Suggested

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Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Student will be able to Classify and discuss the structure and function of ecosystems.	1,2,3,4
CO2	Describe symbiotic and synergic relationships.	1,2,3,4
CO3	Illustrate the need for bio- geo- cycles. Apply ecosystem models.	1,2,3,4
CO4	Describe the importance of modelling and its applications.	1,2,3,4
CO5	To evaluate the data collection and analysis. Achieve knowledge mixing zones in rivers, Eutrophication.	1,2,3,4

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Semester- II

Hazardous Waste Management			
Course Code	MCWH215A	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

This course will enable students to;

- have knowledge on need and principles of Hazardous waste management.
- risk assessment, management and methodologies to handle safely the hazardous waste.
- Provide detailed aspects on the treatment and disposal methods of Hazardous wastes.

Module-1

Introduction: Hazardous waste management, Ignitability, Corrosivity, Reactivity, Toxicity. Sources & Classification of hazardous waste, Legislation conditions of hazardous waste Management, case study – String fellow site chemicals, life styles and the environment public and Government awareness of hazardous waste.

Toxicity and risk management: health of people exposed to toxic chemicals, relationship of toxicology to hazardous waste management. Case study-risk assessment of Leukemia from human exposure to Benzene.

Module-2

Environmental Legislation and Regulations: Rivers and Harbor's Act, Atomic energy act of 1984, the national environmental pollution act, occupational safety and health act. The calm air act, motor vehicles emissions. Toxic pollutants, toxic substances control act.

Module-3

EPA designated hazardous waste: mixed waste sampling and analysis, case study- the vanishing zero aor analytical chemistry.

Pollution prevention and waste minimization: governmental policy on waste reduction, benefits of hazardous waste pollution prevention and reduction approaches to hazardous waste pollution prevention and reduction. waste flow diagram, selection of waste minimization process.

Module-4

Physico-chemical Treatment: physical treatment- screening, sedimentation, clarification, cyclone separation, flotation, filtration, adsorption, absorption, evaporation, distillation and condensation reverse osmosis.

Chemical treatment: solubility, neutralization, coagulation and flocculation, jar and extender tests, oxidation and reduction, disinfection, ion exchange, stabilization and fixation systems.

Module-5

Treatment process: Selecting the process, case study- the electireness of treatment technologies for organic hazardous waste.

Transportation and storage of hazardous waste: Transportation of hazardous

waste, POT and EPA coordination, EPA regions. The nuclear regulations commission. Containers for hazardous waste material, Bulk transport.

Thermal process: Incineration process, types, Advantages and disadvantages of incineration, the chemistry of incineration**.**

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:

7. Two Unit Tests each of **25 Marks**
8. Two assignments each of **25 Marks** or **one Skill 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:

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

.

Suggested Learning Resources:

Books

1. . Lehman, (1983), **"Hazardous Waste Disposal"**, Plenum Press.
2. Lagrega M.D., Buckingham P.L., and Evans J.C., (1994), **"Hazardous Waste Management**", McGraw Hill International Edition.
3. Wentz C.A., (1989), "**Hazardous Waste Management**", McGraw Hill.
4. Dawson and Mercer, (1981), **"Hazardous Waste Management**", John Wiley.
5. Fawcett, (1984), "**Hazardous and Toxic Materials: Safe Handling and Disposal"**, John Wiley.
6. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "**Industrial Safety and Pollution Control Handbook"**

Web links and Video Lectures (e-Resources):

- .

Skill Development Activities Suggested

- Visiting to near by sites.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Identify the sources and describe characteristics of hazardous wastes.	1,2.3
CO2	Review of case studies with respect to risk identification, assessment and emergency preparedness.	1,2,3,4
CO3	Enumerate on waste minimization and resource recovery techniques.	1,2,3
CO4	Prepare the transportation protocol for safe transport of hazardous wastes.	1,2,3

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Semester- II

Community Health Science and Management			
Course Code	MCWH215B	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

This course will enable students to;

- Know the concept of medicine to words Community health.
- Know the concept of health and disease.
- Communicable diseases, Control & prevention in rural and urban area.
- To know the principles of Epidemiology, prevention of Communicable diseases and Risk Approach.
- To know about the nutrition of health and to Understand the objectives and maintenance of Environmental Sanitation.

Module-1

Introduction: Concept of Health, Communicable and Non communicable Diseases, classification of Communicable diseases Methods of communication, general methods and control.

Community Health and Sanitation: Importance of Community Health, Environmental Sanitation, Rural and urban sanitation, Classification of Health, Physical, Mental , Social Health Science.

Module-2

Principles of Epidemiology: Epidemiology and Aims of Epidemiology, Basic measurements, Common Sources of Epidemics and Control measures, Causes of Epidemiology.

Concept of Disease Transmission and Prevention: Dynamics of Disease Transmission, modes of Disease Transmission, concept of screening, types & uses of screening.

Module-3

Epidemiology of communicable diseases and control: Small pox & chicken pox and their differences. Measles, rubella, influenza, yellow fever, chicken gunya, Cholera, Typhoid and their control.

Global Epidemic Diseases: Bird flu, Insect Control: study on Life cycle of House fly and Mosquito. disease Transmission and control measures.

Module-4

Food and Milk Sanitation: Food Poisoning, Types and sources. Prevention and Control measures, Essentials for milk sanitation and Test for milk quality, Pasteurization, Cattle Born Diseases.

Nutrition of health: Nutrients, proteins, fats and carbohydrates.utritional problems in public health and surveillance.

Module-5

Environmental sanitation: Environmental sanitation, Rural and Urban sanitation. Importance of safe drinking water, water borne diseases and control, methods of waste disposal.

Occupational health and Safety: Occupational health hazards and diseases, health of worker and safety measures.

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:

9. Two Unit Tests each of **25 Marks**
10. Two assignments each of **25 Marks** or **one Skill 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:

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

Suggested Learning Resources:

Books

1.. Joseph .A. Salvato, by Environmental Sanitation.
2. E.W. Steel , Water Supply and Sanitary Engineering,
3. **J.E. Park and K. Park,** Preventive and Social medicine, M/S. Banarsidas
4. Bhanot Publications.
5. **Baljeeth s kapoor,** Environmental sanitation, S Chand & Co.
6. **P.K. Goel,** Water Pollution Causes, Effects and Control, New AgeInternational (Pvt.) Ltd

Web links and Video Lectures (e-Resources):

Skill Development Activities Suggested :

- Visiting to nearby hospitals.
- Meeting with community health doctors.

Course outcome (Course Skill Set)
At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	To understand the roll and important concepts of health.	1,2.3.4
CO2	To understand the Dynamics of Disease Transmission and control measures.	1,2,3,4
CO3	To know about the principles of epidemiology.	1,2,3,4
CO4	To know about food sanitation and nutrients.	1,2,3,4
CO5	Control and remedial measures to maintain good Sanitation.	1,2,3,4

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Semester- II

Hydraulics of Water and Waste Water			
Course Code	MCWH215C	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

This course will enable students to;

- Formulate momentum, energy and mass transport models
- Solve diffusion-dispersion equations.
- Apply basic flow equations for steady and unsteady flows in open channels

Module-1

Introduction: Water Supply System-types of systems, population forecasting methods, water demands, pressure, design period, Pipe materials and roughness coefficient.

Storage Reservoirs – Site selection**,** Need, different types, capacity determination and evaluation of pumping system.

Pipe Networks – Peak factors for intermittent and continuous distribution system. Branch and Grid Iron systems. Design Layouts of distribution systems, Evaluation of distribution system.

Module-2

Basic concepts of open channel flows; conservation laws, continuity equation, momentum equation, Application of momentum and energy equations. Critical flow, its properties and application; location of critical flow and its computation

Uniform flow; flow resistance, equations of flow resistance, computation of normal depth, Gradually varied flow, governing equations classification of water surface profiles.

Module-3

Hydrologic processes; Hydrologic cycle and its interaction with human activity, Hydrologic analysis, Hydrologic statistics. Transport processes.

Diffusion system- phenomena, Flicks' First and second Laws of diffusion, Advection diffusion equation, Turbulent diffusion and dispersion mixing phenomenon in rivers, Contaminant transport system, Saltwater intrusion into aquifers, Non aqueous phase liquid (NAPL) in groundwater.

Module-4

Water Quality in Distribution System – Factors affecting water quality, predictive tools and intermediate disinfection.

Wastewater Collection System – Separate and Combined Sewer Systems, relevant equations for flow conditions, Pipe materials and roughness coefficient, design guidelines and examples. Sewer Appurtenances.

Module-5

Sewer Network – Estimation of Nodal Flows, Pumping Stations, Evaluation of Different Network Options.

Storm Sewers – Flooding and water quality problems, run-off calculations, storm water inlets, open drains and sewer pipes and design for different conditions of flow of storm sewage.

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:

11. Two Unit Tests each of **25 Marks**
12. Two assignments each of **25 Marks** or **one Skill 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:

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

.

Suggested Learning Resources:

Books

1. Sincero A.P., and Sincero G.A., (1999), "**Environmental Engineering – A Design Approach",** Prentice Hall of India Pvt. Ltd., New Delhi.
2. Hammer M.J., and Hammer Jr. M.J., (2008), **"Water and Wastewater Technology**", Prentice Hall of India Pvt. Ltd., New Delhi.
3. Walski T.M., (1987), "**Analysis of Water Distribution Systems**", CBS Publications, New Delhi."

Web links and Video Lectures (e-Resources):

- https://openjicareport.jica.go.jp › pdf
- http://designwss.weebly.com › uploads › ch1
- https://web.iitd.ac.in › files › CEL795_2011
- https://www.researchgate.net › publication › 350843795...
- https://scholarsbank.uoregon.edu › handle › Tal...

Skill Development Activities Suggested

- Visiting to nearby sewage treatment plant.
- Visiting to nearby hydrology research centre.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	solve basic equations of flow through porous medium	1,2
CO2	formulate forecast models for operation of hydrologic systems.	1,2,3
CO3	Understand the diffusion system in ground water system.	1,2

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Semester- II

Environmental Planning and Management			
Course Code	MCWH215D	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

This course will enable students to;

- Understand the management and to apply the skills of the management when they become an entrepreneur.
- Understand Organization & Purpose of organization.
- Role of Entrepreneurs in India.
- Various Policies of Government.

Module-1

Introduction– Nature and characteristics of Management, Scope and functional areas of management– Management as a science, Art or Professional Management.

Administration–Role of Management, Levels of Management, Development of Management thought–Early management approaches, Modern management approaches. Planning Nature, Importance and purpose of planning process– Objectives, Types of planning, Decision making – Importance of planning, Steps in planning & planning premises, Hierarchy of plans.

Module-2

Organization and Staffing- Nature and purpose of organization, Principles of organization, Types of organization – Departmentation, Committees, Centralization Vs Decentralization of authority and responsibility ,Span of control – MBO and MBE (Meaning only) Nature and importance of Staffing – Process of Selection & Recruitment.

Direction & Control- Meaning and nature of directing –Leadership styles, Motivation Theories, Communication – Meaning and importance – Coordination, meaning and importance and Techniques of Coordination. Meaning and steps in controlling – Essentials of a sound control system – Methods of establishing control.

Module-3

Entrepreneurship-Meaning of Entrepreneur, Evolution of Concept, Functions of Entrepreneur, Types of Entrepreneur, Entrepreneur – an emerging class. Concept of Entrepreneurship –Evolution of Entrepreneurship.

Development of Entrepreneurship: Stages in entrepreneurial process, Role of Entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

Module-4

Small Scale Industry-Definition, Characteristics, Need and rationale, Objectives, Scope, role of SSI in Economic Development. Advantages of SSI. Steps to start an SSI – Government policy towards SSI.

Policies- Different Policies of SSI., Government Support on SSI., during 5year

plans. Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO / GATT Supporting Agencies of Government for SSI Meaning. Nature of support, Objectives, Functions.

Module-5

Small Scale Industry-Definition, Characteristics, Need and rationale, Objectives, Scope, role of SSI in Economic Development. Advantages of SSI. Steps to start an SSI – Government policy towards SSI.

Policies- Different Policies of SSI., Government Support on SSI., during 5year plans. Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO / GATT Supporting Agencies of Government for SSI Meaning. Nature of support, Objectives, Functions.

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:

13. Two Unit Tests each of **25 Marks**
14. Two assignments each of **25 Marks** or **one Skill 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:

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

.

Suggested Learning Resources:

Books:

- Principles of Management – P.C. Tripathi, P.N. Reddy, Tata McGraw Hill,
- Dynamics of Entrepreneurial Development & Management – Vasant Desai, Himalaya Publishing House.
- Entrepreneurship Development – Small Business Enterprises – Poornima M. Charantimath – Pearson Education – 2006 (2&4).

Web links and Video Lectures (e-Resources):

Skill Development Activities Suggested

- Visiting to city and town planning authority office.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Identify, select a suitable Project	1,2
CO2	Write a Project Report, with formulation and understand the Guide lines by Planning Commission for Project Report.	1,2,3,4
CO3	Understand the basic things required to become a Entrepreneur	1,2,3,4
CO4	Understand the policies and regulation for industries.	1,2,3,4
CO5	Understand the importance of planning and network analysis of Project.	1,2,3,4

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Semester- II

Renewable and Non-Renewable Energy Resources			
Course Code	MCWH216A	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

This course will enable students to:

- Gain the Knowledge on conventional and non-conventional energy resources.
- Understand about the Bio-mass, bio energy, biogas plants with their functions.
- Understand about solar radiation, power generation and its utilization.
- Understand about geothermal energy and tidal energy generation and utilization.
- Understand about the nuclear power generation, utilization and nuclear waste disposal methods.

Module-1

Introduction: sources of energy, primary energy resources and secondary energy resources, world renewable energy resources and energy strategies. Renewable and non- renewable energy sources and availability. Conventional and non-conventional energy sources. use of various sources of energy consumption in the world.

Fossil Fuels: Classification of fossil fuels, composition, Physico-chemical characteristics, natural Gas formation, exploration, Mining and uses of coal oil and uses of natural gas.

Module-2

Bio-Energy: Bio-Mass energy, Bio mass Conversion technologies, Benefits of using Biomass, bio-fuels, bio-power, bio-products. Biogas production and uses. Classification of biogas plants. Indian floating type gas digester (KVIC), Fixed dome type digester. Advantages and disadvantages. problems involved with biogas production. Factors affecting generation of Biogas.

Module-3

Solar Energy: Introduction, solar radiation at earth's surface, Beam and Diffuse solar radiation. Measurement ofsolar radiation. Solar energy collectors-concentrating and non- concentrating collectors, advantages and disadvantages. Physical principles of conservation of solar radiation into heat energy.

Solar Electricity generation: Solar Photo-voltaic, solar distillation, solar furnace and solar cooking, advantages and disadvantages. Solar Pond construction and principle of operation. Electric power generation from solar ponds.

Module-4

Geo-thermal Energy: Introduction on energy from Earth, applications of Geo thermal energy, Geo-thermal resources, hydro-thermal resources, Geo- pressured resources, Petro-thermal resources, Magma resources. Advantages and disadvantages over other energy forms.

Tidal Energy: Introduction, Ocean Thermal Energy Conversion (OTEC), Open cycle and Closed cycle system for OTEC, Energy from Tides-basic principles of Tidal power generation, Components of Tidal power plants, advantages and limitations of Tidal power generation.

Module-5

Nuclear Energy: Introduction, Nuclear Energy, advantages and disadvantages of Nuclear power plants, Nuclear fission and Nuclear fusion concepts and necessity.

Nuclear Reactors: General components of Nuclear reactors. Classification of Nuclear Reactors, types of nuclear reactors, PWR and BWR. Location of Nuclear power plant, types of nuclear waste and methods of disposal of Nuclear waste.

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:

15. Two Unit Tests each of **25 Marks**
16. Two assignments each of **25 Marks** or **one Skill 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:

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

Suggested Learning Resources:

Books:

- . Mathur, A.N., and Rathore, N.S., "Renewable Energy and Environment" – Proceedings of the National Solar Energy, Himanshu Publications, Udaipur.
- Rao and Parulekar B.B., (1977), "Energy Technology– Non-conventional,
- Renewable and Conventional Energy Resources", 2nd Edition, Khanna Publishers.
- Rai, G.D , "Non-conventional Energy Sources", Khanna Publications.

Web links and Video Lectures (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

Skill Development Activities Suggested

- Visit to the nearby renewable energy plants
- Study on Solar Power system established.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand the various resources of Energy and its utilization.	1,2
CO2	know about Conventional and Non-conventional energy resources.	1,2,3,4
CO3	know about Bio-fuels, bio-energy and bio-gas plants.	1,2,3,4
CO4	know about solar energy, Geothermal energy, Tidal energy and nuclear energy with their merits and demerits	1,2,3,4
CO5	know about Bio-fuels, bio-energy and bio-gas plants.	1,2,3,4

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Semester- II

Industrial Effluents Treatment Technology			
Course Code	**MCWH216B**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

This course will enable students to;

- Understanding the Industrial effluent characteristics and their effects on environment.
- Understand treatment and disposal alternatives of industrial effluents.
- Understand the reduction of organic and inorganic dissolved solids from effluents.
- Understand a specific treatment and disposal technics from specific industries.

Module-1

Effects of Industrial Wastes on sewerage system and sewage treatment plants and receiving water bodies. Effects of waste additions on physical and chemical properties of soil.

Effluent standards and receiving water quality standards. Different aspects and choices of various disposal alternatives.

Module-2

Industrial Waste Survey-Process flow charts, condition of waste stream. Material balance, Sampling-Grab, Composite and integrated samples. Continuous monitoring : pH, Conductivity, Bio-monitoring.

Module-3

Pre-treatment of Industrial Wastewater–Volume reduction, Strength reduction, Neutralization, Equalization and Proportion, Removal of Organic and inorganic dissolved solids.

Module-4

Wastewater Treatment for specific industries: Distillery, Sugar Industry, Pulp and paper, Cement Industry, Textile, Dairy Industry, Fertilizer, Pesticides and Pharmaceutical industries.

Module-5

Design of complete treatment system & disposal of Effluents: Distillery, Diary, Sugar Paper and Pulp mill to meet PCB. standards.

Treatment of Radio Active Wastes - Low activity and high activity radiation, application of radioactive techniques for wastewater treatment. **Bio-Remediation** of contaminated soils.

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:

17. Two Unit Tests each of **25 Marks**
18. Two assignments each of **25 Marks** or **one Skill 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:

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

.

Suggested Learning Resources:

Books

- "Wastewater Engineering - Treatment and Reuse", Metcalf and Eddy Inc., (2003), 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- "Wastewater Treatment Concepts and Design Approach", Karia G.L., and Christian R.A., (2001), Prentice Hall of India Pvt. Ltd., New Delhi.
- "Wastewater Treatment", Rao M.N., Datta A.K., (2008), 3rd edition,
- Oxford & IBH Publishing Co. New Delhi.
- Nemerow N.N., (1971) – "Liquid Waste of industry theories, "Practices and Treatment, Addison Willey New York.
- "Wastewater Engineering - Treatment and Reuse", Metcalf and Eddy Inc., (2003), 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Web links and Video Lectures (e-Resources):

- https://bmsit.ac.in › pdf › civil › studymaterial
- https://www.researchgate.net › ... › Industrialization
- https://www.internationaljournalssrg.org › IJCE
- https://en.wikipedia.org › wiki › Industrial_wastewater_tr...
- https://www.netsolwater.com › Blog - STP - ETP

Skill Development Activities Suggested

- Visit to near by industrial effluent treatment plant.
- Study on experimental analysis wrt effluent samples.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To understand the role and importance of industrial waste water management.	1,2
CO2	Understand the basics of treatment methodologies.	1,2,3
CO3	Understand basics on removal of organic & inorganic dissolved solids.	1,2
CO4	Understand the safe disposal methods of industrial effluents.	1,2

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Semester- II

Ecology and Environmental System			
Course Code	**MCWH216C**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

This course will enable students to;

- Gain the Knowledge on Ecology & Environment.
- Understand about the aquatic and Terrestrial Ecosystem.
- Understand about System Ecology.
- Understand about Ecosystem modelling.

Module-1

Ecology: Classification of Ecosystems, Structure and Function of Ecosystems, Energy flow in Ecosystems, Ecological Niche and succession, Bio-geochemical cycles, Ecological Pyramids.

Module-2

Aquatic and Terrestrial Ecosystems: Diversity and dominance Indices, Ecosystem Models.

Lake Ecosystem: Trophic levels, nutrient loading, nutrient enrichment, Leibig's Law, control of eutrophication.

Module-3

Systems ecology: Systems ecology and ecosystems modelling biodiversity and ecological perspective -human benefits, threats, conservation preservation and protection

Module-4

Ecosystem Modelling: Ecosystem models and their environmental applications, Types of Models, Model Design.

Module-5

Environmental Education and Information: Goals, Objectives and guiding Principles of Environmental educations. Environmental educational Programs; Environmental Education in India.

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:

19. Two Unit Tests each of **25 Marks**
20. Two assignments each of **25 Marks** or **one Skill 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:

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

.

Suggested Learning Resources:

Books

- Kormondy, "Concepts of Ecology", Prentice Hall Publication, New Jersey.
- Odum, "Fundamentals of Ecology", Adisson Co.
- Krebs J., "Ecology - The Experimental Analysis of Distribution and Abundance", I Edition, Harper International.
- Hall C.A.S., and Day J.W., "Ecosystem Modeling in Theory and Practice: An Introduction with Case
    - Histories", JohnWilley.
- Verma P.S and Agarwal V.K 1998. Concept of Ecology, S. Chand and company Ltd.,

Web links and Video Lectures (e-Resources):

- https://www.conserve-energy-future.com/types-importance-examples-ecology.php
- https://www.environmentalpollution.in/ecosystem/aquatic-ecosystem-and-terrestrial-ecosystem- explained-with-diagram/260
- https://onlinecourses.nptel.ac.in/noc22_hs125/preview
- https://www.conserve-energy-future.com/environmental-education-and-its-components.php

Skill Development Activities Suggested

- Development of models on ecosystems.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Develop an appreciation of the modern scope of scientific inquiry in the field of Ecology	1,2
CO2	Become familiar with the variety of ways that organisms interact with both the physical and the biological environment	1,2,3,4
CO3	Develop an understanding of the differences in the structure and function of different types of ecosystems	1,2,3,4
CO4	Understand about Ecosystem modelling.	1,2,3,4
CO5	Develop an understanding of the differences in the structure and function of different types of ecosystems	1,2,3,4

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Semester-II

Human Impact on Marine and Coastal Environment			
Course Code	**MCWH216D**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 hours of Teaching + 10-12 sessions of SDA	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

This course will enable students to;

- To provide students understanding of the materials and processes associated with the major hazards.
- To provide natural geo-hazards: floods, earthquakes, volcanic activity, landslides, and coastal hazards.
- Study on Coastal Environment.
- To Coastal Hazards Management Framework -Hazard Mitigation Planning.

Module-1

Estuaries and Saltwater Marshes; Adaptations of Estuarine and Saltwater Organisms – Sea-grass Ecosystem – Mangrove Ecosystem – Barrier Islands, Biogeography – Coral.

Reefs and Atolls – Open Ocean – Marine Benthos and Tidal Communities – Human Impact on the Marine Environment.

Module-2

Coastal Hazard: Coastal Hazard; Natural vs. Man-made hazard - Cyclones, Coastal Erosion, Tsunami, Flood, Storm surges, Sea Level Rise and Others – Impacts on Natural and Human environment.

Module-3

The Human Coast: The Human Coast - Governance of the Coast: Institutions, Policy and Jurisdictions – Technological Hazards - Biological and Anthropogenic Coastal Hazards - Hazards and Disasters; Definition, Causes, Effects, Differences and their relationship to each other.

Module-4

Case Studies Examples – Case Studies – Lessons Learnt – Preparing for the Future growth.

Module-5

Coastal Hazard Management Ethical Dimensions - Competing Values - Growth Management: tools, plans, principles – Mitigation: Definition, approaches, types and examples - Coastal Hazards Management Framework -Hazard Mitigation Planning.

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:

21. Two Unit Tests each of **25 Marks**
22. Two assignments each of **25 Marks** or **one Skill 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:

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

.

Suggested Learning Resources:

Books

- Barnes, R.S.K. and Hughes, R.N. Introduction to Marine Ecology, 3rded.,Blackwell Publishing, 1999.
- Beatley, T., David, J.B. and Anna, K.S. An Introduction to Coastal ZoneManagement, Island Press, Washington D.C., 2002.
- Bryant, E., Natural Hazards, Cambridge University Press, New York,2006.
- Burby, R.J., ed., Cooperating WithNature: Confronting Natural Hazards With Land-
- Use Planning for Sustainable Communities, Joseph Henry Press, Washington D.C. 1998.)

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=eIs4M_2QG0
- https://www.youtube.com/watch?v=C-JVJTwQgLI&list=PLbMVogVj5nJTirggwW73R_PPtqi4VRzxm
- https://www.youtube.com/watch?v=kgVRlG42VNE&list=PLbMVogVj5nJTirggwW73R_PPtqi4VRzxm&inde x=10
- https://www.youtube.com/watch?v=CxgwgMtzrsQ&list=PLbRMhDVUMngdZvhdNC31fHsV_HLl W5Jby

Skill Development Activities Suggested

- Site visit.
- Visiting to Research Centres to study on Natural Costal Environmental system.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand the systems of Estuaries and Saltwater Marshes.	1,2
CO2	Analyse of Impacts on Natural and Human environment.	1,2,3,4
CO3	Understand the Coastal Hazard Management	1,2,3,4

Program Outcome of this course

Sl. No.	Description	POs
1.	Engineering Knowledge	**PO1**
2.	Problem Analysis	**PO2**
3.	Design / Development Solutions	**PO3**
4.	Conduct Investigations of Complex problems	**PO4**
5.	Modern tool usage	**PO5**
6.	Engineer and Society	**PO6**
7.	Environment and Sustainability	**PO7**
8.	Ethics	**PO8**
9.	Individual and Team-Work	**PO9**
10.	Communication	**PO10**
11.	Project Management and Finance	**PO11**
12.	Life-long Learning	**PO12**

Mapping of COS and POs

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

Water and Wastewater Analysis Lab-I			
Course Code	**MCWHL207**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	01:00:02:00	SEE Marks	50
Credits	2	Total Marks	100
Examination Type (SEE)	Practical	Exam Hours	03

Course objectives:

This course will enable the students to;

- Understand the Concept, objectives and significance of water testing and waste waters from various sources.
- Getting basic knowledge on preparation of various chemical solutions required for testing of water and waste water samples.
- Gaining basic knowledge of analysis for small projects on water and wastewater Engineering.

Sl. NO.	Experiments
1	Sampling techniques and Preservation of water and wastewater samples.
2	Preparation of Standard Chemical solutions.
3	Determination of pH by various methods,
4	Determination of Electrical Conductivity and TDS.
5	Determination of Acidity in a given sample of water.
6	Determination of Alkalinity in a given sample of water.
7	Determination of Calcium, Magnesium and Total Hardness in a given water and waste water sample.
8	Determination of percentage of Chlorine in Bleaching powder and determination of residual Chlorine.
	Demonstration Experiments (For CIE) if any
9	Determination of Turbidity by Nephelometer.
10	Determination of Optimum Coagulant Dosage using Flocculator.
11	Use of Muffle furnace for various purpose.
12	Determination of Dissolved Oxygen in a Sample of Water.

Course outcomes (Course Skill Set):

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

- Achieve the Knowledge of development of experimental skills.
- Understand the principles of design of experiments.
- Knowing the Objectives and principles to carry out experimental Projects.

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 marks is 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:
Books:

- Manual of Water and Wastewater Analysis – NEERI Publications.
- Standard Methods for Examination of Water and Wastewater, American Publication Health Association (APHA), Water Pollution Control Federation, American Water Works Association (AWWA),Washington DC.- latest edition.
- BIS Standards and WHO Guidelines.
- Chemistry for Environmental Engineering by Sawyer and Mc. Carty.

PCC/PCCL/IPCC/PEC/MDC/PCC(PB): These are the courses which will suit the individual

Specializations:

Skill and Ability enhancement courses for PG Level Civil Engineering courses			
Course Code	MCWH258	CIE Marks	50
Credits	01	SEE Marks	50

Skill and Ability Enhancement Courses for PG Level Civil Engineering Courses

Preamble

The Ability Enhancement and Skill Development Course at the postgraduate level is designed to strengthen students' core competencies and equip them with essential skills for academic and professional advancement. This course focuses on developing critical thinking, academic writing, research methodology, digital literacy, communication, and ethical reasoning to support advanced learning and scholarly engagement. It also emphasizes skill development in areas such as problem-solving, data analysis, entrepreneurship, project management, and the use of discipline-specific tools and technologies. Aligned with the objectives of the National Education Policy (NEP) 2020, the course aims to enhance employability, innovation capacity, and leadership qualities among postgraduate students.

Procedure to take up Skill and Ability enhancement courses for PG Level Civil Engineering courses

Students may opt the subjects from NPTEL (National Programme on Technology Enhanced Learning) online course list and VTU online courses offered during the current semester, subject to the approval of the Department and as per university regulations. The selected course must be relevant to the student's postgraduate program, contribute to academic or professional development, and not duplicate content already covered in the core curriculum. A NPTEL or VTU online course in the semester may be permitted for credit transfer or academic enrichment, provided the course includes assessments such as assignments and proctored examinations. Students must submit their course selection for departmental approval within the first two weeks of the semester. Successful completion of the course, including passing the final certification exam (online) will be required for academic credit or consideration under skill enhancement components.

Some of the Generalized Subjects but not limited for Skill Development Courses (SDC) and Ability Enhancement Courses (AEC)

- Environmental Data Analysis and Simulation Tools

- Disaster Risk Reduction and Management in Infrastructure
- Smart Infrastructure and IoT Applications in Civil Engineering
- Legal Aspects, Contracts, and Arbitration in Construction
- Technical Communication and Scientific Writing for Engineers
- Entrepreneurship and Innovation in Civil Engineering
- Project Formulation and Proposal Writing
- Digital Literacy and Software Tools for Engineering Research
- Intellectual Property Rights and Patent Drafting
- Leadership and Team Management in Engineering Contexts
- Other skill enhancement courses suggested by the respective programs.
