Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme

Programme Name : Advanced Diploma in Environmental Engineering

Programme Code : EZ **With Effect From Academic Year: 2023 - 24**

Duration of Programme : One Year (Two Semesters) **Pattern : Semester (Full Time)** **Duration : 16 Weeks**

Semester : First **Scheme : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total
								Theory							Practical						
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
				L	T	P			Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
a	b	c	d	e	f	g	h(e+f+g)	i	j	k	l	m	n(j+l)	o	p	q	r	s	t(p+r)	u	v(n+t)
1	Environmental Ecology and Microbiology	EEM	28112	4	--	--	4	1.5	70*#	35	30*	00	**100**	50	--	--	--	--	--	--	**100**
2	Environmental Chemistry and Pollution	ECP	28113	4	--	--	4	1.5	70*#	35	30*	00	**100**	50	--	--	--	--	--	--	**100**
3	Environmental Monitoring	ETO	28016	4	--	4	8	--	--	--	--	--	--	--	50#$	25	50	25	**100**	50	**100**
4	Pollution Control and Waste Management	PCW	28017	4	--	4	8	--	--	--	--	--	--	--	50@ $	25	50	25	**100**	50	**100**
5	Environmental and Industrial Hygiene, Occupational Health and Safety	EIH	28018	4	--	2	6	--	--	--	--	--	--	--	50#$	25	50	25	**100**	50	**100**
Total				**20**	--	**10**	**30**	--	**140**	--	**60**	--	**200**	--	**150**	--	**150**	--	**300**	--	**500**

Student Contact Hours Per Week: **30 Hrs.** **Theory and practical periods of 60 minutes each.** Medium of Instruction: **English** Total Marks : **500**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@Internal Assessment, # External Assessment, *# On Line Examination

* The average of 2 test to be taken during the semester for the assessment.

#$ External PR ESE and average of 2 Skill tests / Practicals.

@$ Internal PR ESE and average of 2 Skill tests / Practicals.

If student remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE.

- **Candidates not securing minimum marks for passing the "PA" part of practical of any course is declared as "Detained" for that semester.**
- **During Internship and Project period students shall attend Institute one day in a week to meet the mentor and appraise about the progress. The log book, Project Diary and Internship performance shall be recorded by the mentor for progressive assessment.**

Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme

Programme Name : Advanced Diploma in Environmental Engineering

Programme Code : EZ **With Effect From Academic Year: 2023 - 24**

Duration of Programme : One Year (Two Semesters) **Pattern : Semester (Full Time)** **Duration : 16 Weeks**

Semester : Second **Scheme : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total
								Theory							Practical						
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
				L	T	P			Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
a	b	c	d	e	f	g	h(e+f+g)	i	j	k	l	m	n(j+l)	o	p	q	r	s	t(p+r)	u	v(n+t)
1	Environmental Management	EZS	28208	4	--	--	4	1.5	70*#	35	30*	00	**100**	50	--	--	--	--	--	--	**100**
2	Project	PEZ	28068	--	--	8	8	--	--	--	--	--	--	--	50#	25	50	25	**100**	50	**100**
3	Industrial Training	IAI	28069	--	--	18	18	--	--	--	--	--	--	--	100#	50	100	50	**200**	100	**200**
			Total	**04**	**--**	**26**	**30**	--	**70**	--	**30**	--	**100**	--	**150**	--	**150**	--	**300**	--	**400**

Student Contact Hours Per Week: **30 Hrs. Theory and practical periods of 60 minutes each.** Medium of Instruction: **English** Total Marks : **400**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@Internal Assessment, # External Assessment, *# On Line Examination

* The average of 2 test to be taken during the semester for the assessment.

#$ External PR ESE and average of 2 Skill tests / Practicals.

@$ Internal PR ESE and average of 2 Skill tests / Practicals.

If student remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE.

- **Candidates not securing minimum marks for passing the "PA" part of practical of any course is declared as "Detained" for that semester.**
- **During Internship and Project period students shall attend Institute one day in a week to meet the mentor and appraise about the progress. The log book, Project Diary and Internship performance shall be recorded by the mentor for progressive assessment.**

Note : The Institute is required to sign MOU with related local authories for Industrial Training

PROGRAMME NAME : ADVANCED DIPLOMA IN ENVIRONMENTAL ENGINEERING

PROGRAMME CODE : EZ

SEMESTER : FIRST

COURSE TITLE : ENVIRONMENTAL ECOLOGY AND MICROBIOLOGY

COURSE CODE : 28112

1. RATIONALE

This subject provides an insight to the students on the basic concepts related to Environmental Ecology, Ecosystems and Microbiology. It describes factors affecting ecosystems and enlists impacts of Microbial Ecology-Interactions. It orients the students to implement the acquired knowledge to prevent ecological damage as well as utilization of microorganisms in environmental pollution control, monitoring techniques and effective waste management.

2. COMPETENCY

The students will be able to identify various ecological and microbiological factors affecting environment and use various techniques to control the adverse effects of these.

3. COURSE OUTCOMES

- Acquire knowledge of basic concepts of ecology and ecosystem interactions.
- Develop an understanding of interaction and interrelationship of various spheres in ecology.
- Recognize different ecological factors.
- Associate the natural growth and death pattern of microorganisms with the methods adopted for disinfection purpose
- Acquire knowledge of the concept of Biodegradation & Bioremediation techniques for environment pollution control.
- Discover various microbial diseases and measures to control them.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme												
				Theory							Practical					
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	-	4	1.5	70*#	35	30*	00	100	50	-	-	-	-	-	-

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends:** L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P-Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*

*@Internal Assessment, #External Assessment, *#Online Examination*

5. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours	Marks
I	**Concepts in Ecology** • The terms- ecology, environment, multidisciplinary approach, place in other branches of learning. • Taxonomy and ecology. • Levels of organizations in environment, the ecosystem concept, structure and functions in an ecosystem. • Organisms-Organism & Organism- environment relationships and principles. • **An Introduction to Biodiversity and Loss of biodiversity** • **An Introduction to Climate Change related Impacts on Ecology.**	**08**	**10**
II	**Introduction to various spheres in Ecology** • Atmosphere- origin, composition, altitudinal expanse. • Hydrosphere- geographical distribution, estimated quantities of water in different places, natural composition of fresh and marine water, important physiochemical properties of water. • Lithosphere- Weathering and soil formation, sedimentation cycles in time and space. Rocks and their classification. Soil profiles, their physical and chemical properties, Classification of soils in India, major plant nutrients and other minerals in soil and their mineralization. Minerals and their classification. • Biosphere- origin and distribution on land, in water and in air. Broad nature of chemical composition of plants and animals. Nature cycles- general path of materials in bio- geochemical cycles • Nature of interface between different spheres.	**12**	**12**
III	**Ecological Factors** • Ecological Factors affecting ecosystem. • Temperature- temperature regimes & survival of organism, temperature belts, cardinal point- maxima, minima, optima. • Solar radiations- intensity, duration related effects, photoperiodism, effect on photosynthesis, compensation point, impact on vegetative and reproductive growth. • Water- Water as a limiting factor, excess and deficient water, rains- quantity, duration (i.e. distribution of rainfall in a year) snow, dew, role of water in the metabolism of plants and animals, growth medium, types of habitats according to water availability. • Land- topography, mineral status, physical and chemical nature. Land use- capability and determinants.	**12**	**12**
IV	**Environmental Microbiology I** • Microbial Ecology & Environmental Microbiology: Concepts, definitions, classification and principles. • Growth of micro-organisms [Biological growth curve,	**12**	**12**

Unit	Topic and Contents	Hours	Marks
	significance of each stage]: factors affecting growth. Death of micro-organisms [Physical and chemical sterilization techniques] • Microbiology of Air and Water: • Types of microorganisms in Air and Water • Factors affecting the kind and no. of micro-organisms in Air and Water. Methods of purification of Air and Water.		
V	**Environmental Microbiology II** • An introduction to Biodegradation & Bioremediation, • Microorganisms as pollution indicators, • Microbial biodegradation of pesticides, hydrocarbons, detergents & oil • Microbial bioremediation to clean up the environment.	**10**	**12**
VI	**Environmental Biotechnology and Human Health** • Changing environment and changing pattern of disease, ailment of respiratory tract, waterborne diseases, heavy metal induced diseases. • Vector borne diseases. • Epidemiological approach, dose response curves, costs externalities, impact externalities. • Mechanism of parasite action (Plasmodium falciparium, P. ovale, P. vivax, P. malariae) and control measures, including biological control.	**10**	**12**
Total		**64**	**70**

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Concepts in Ecology	08	06	04	00	10
II	Introduction to various spheres in ecology	12	02	08	02	12
III	Ecological Factors	12	02	06	04	12
IV	Environmental Microbiology I	12	02	05	05	12
V	Environmental Microbiology II	10	02	05	05	12
VI	Environmental Biotechnology and Human Health	10	02	05	05	12
Total		**64**	**16**	**33**	**21**	**70**

Legends: *R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)*

Note*: The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

7. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Essentials of Ecology and Environmental Sciences	S.V.S. Rana	Prentice Hall of India, New Delhi
2	Fundamentals of Ecology	E.P. Odum and G.W. Barrett	Thomson Asia Pvt. Ltd., Singapore
3	Microbiology	Pelczar Michael J. & Others	McGraw Hill Education
4	Bioremediation technology recent advances	M.H. Fulekar	Springer

8. SOFTWARE/LEARNING WEBSITES

- https://www.fao.org/ecosystem-services-biodiversity/en/
- https://parivesh.nic.in/
- https://www.web-ecology.net/
- http://indianecologicalsociety.com/society/
- http://indianecologicalsociety.com/society/journal/
- https://www.india.gov.in/topics/environment-forest
- https://www.indiawaterportal.org/articles/bioremediation-its-applications-contaminated-sites-india-state-art-report-ministry
- http://soilhealth.ucdavis.edu/application/files/2015/4207/9078/BioremediationBook.pdf

PROGRAMME NAME : **ADVANCED DIPLOMA IN ENVIRONMENTAL ENGINEERING**

PROGRAMME CODE : **EZ**

SEMESTER : **FIRST**

COURSE TITLE : **ENVIRONMENTAL CHEMISTRY AND POLLUTION**

COURSE CODE : **28113**

1. RATIONALE

Environmental pollution is almost always by the excessive release of chemicals in the environment and therefore it is of prime importance to understand complex chemistry of environment and the fate of chemical pollutants once release in to environment. This course will provide knowledge to the students about the basic concepts of air, water, soil and noise pollution, which will aid to their understanding to abate pollution. They will also understand Environmental Impacts of these polluting parameters, under the various conditions of environment.

2. COMPETENCY

- To measure pollutants in air, water, soil and noise.
- To mitigate measures to control air, water, soil and noise pollution.

3. COURSE OUTCOMES

The students will be able to:

- Acquire knowledge of basic concepts of environmental chemistry
- Gain knowledge of environmental indicators related to pollution
- Comprehend National Ambient Air quality standards and National Clean Air Programme
- Corelate the effect of water pollutants on the use of water for different applications. Various water quality standards
- Describe the detrimental effects of soil pollution on air, and water bodies.
- Identify sources, determine effects and device control measures to control noise pollution.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme											
				Theory							Practical				
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	-	4	1.5	70*#	35	30*	00	100	50	-	-	-	-	-	-

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends: L**-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester*

*Examination, **PA** - Progressive Assessment*

*@Internal Assessment, #External Assessment, *#Online Examination*

5. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours	Marks
I	**Introduction to Environment Chemistry** • Contamination and Pollutants, Medium and Organisms as a receptor and sink as a chemical medium • Introduction to colloidal chemistry, classification, properties and applications in pollution control • An introduction to principles and applications of Adsorption and absorption	06	10
II	**Environmental Indicators by OECD & UNEP** Introduction to Environmental Indicators, Applications & Methods • Chemical measures of water quality include dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD), total dissolved solids (TDS), pH, nutrients (nitrates and phosphorus), heavy metals (including copper, zinc, cadmium, lead and mercury), and pesticides. • Heavy metal contamination of land by industry. • SO_x, NO_x, VOC and NH_3 • Nutrients leaching from agricultural land into water courses • Urban runoff of pollutants washing off impervious surfaces (roads, parking lots and rooftops). • Typical pollutants include gasoline, motor oil and other hydrocarbon compounds, metals, nutrients and sediment (soil). • Organometallic compounds.	12	12
III	**Air Pollution** • The atmosphere, composition of atmospheric air. • Air Pollution - concepts, sources of air pollution natural and anthropogenic. National Ambient Air quality standards. • Primary and secondary air pollutants. Atmospheric reactions, mechanism of transformations and their relationship. • Particulate matter- Sources, classification and composition, particulate dynamics, viable and nonviable particles. • Effects of air pollution on human health, animals and vegetation. • Pollution related phenomena and their consequences- greenhouse effect, global warming and Climate Change, temperature inversion, CFCs and ozone depletion, photochemical smog. • Meteorological aspects: Lapse rates and atmospheric	14	12

Unit	Topic and Contents	Hours	Marks
	stability, temperature inversions. Plume behavior. Meteorological parameters: wind roses, dispersion models. • Global climatic changes and future trends. Net zero, International protocols.		
IV	**Water Pollution** • Characteristics of natural water, aquatic environment. Sources of potable water. • Water quality standards- WHO, EPA and BIS. Industrial water quality standards. • Types of water pollution- physical, chemical, biological and physiological. Sources of water pollution. • Waste waters- domestic, industrial waste waters, their compositions, discharge standards and effects on receiving bodies. • Fate of pollutants in water- metals, non-metals and their specifications. • Pesticides, oil & greases, organic matters, biodegradation, bioaccumulation and their effects on water bodies. • Marine, thermal and radioactive pollution in water and their consequences. • Transport of pollutants, pollutant cycle in environment (Land, air and water).	**14**	**12**
V	**Soil Pollution** • Soil formation process, its components and profile. • Sources of soil pollution- agricultural, industrial, mining and dumping. • Absorption of chemicals and toxic metals by soil and effects. • Detrimental effects of soil pollution: toxicity, diseases caused, impact on air and water bodies.	**10**	**12**
VI	**Noise Pollution** • Sources of noise pollution, measurement of noise and indices. • Effects of meteorological parameters on noise propagation. Noise exposure levels and standards. Impact of noise on human health. • Control of Noise Pollution: Control of industrial and transport noise at source. Noise control in the transmission path, Noise barriers, enclosures and silencers. Protection of the receiver.	**08**	**12**
Total		**64**	**70**

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Environment Chemistry	06	06	04	00	10
II	Environmental Indicators	12	02	05	05	12
III	Air Pollution	14	02	04	06	12
IV	Water Pollution	14	02	04	06	12
V	Soil Pollution	10	02	06	04	12
VI	Noise Pollution	08	02	04	06	12
Total		**64**	**16**	**27**	**27**	**70**

Legends: *R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)*

Note*: The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

7. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Environmental Studies	Anindita Basak	Pearson
2	Environmental Studies	Dr. R. J. Ranjit Danieles & Dr. Jagdish Krishna swami	Wiely India
3	Air Pollution and Plant Life	J.N.B. Bell	John Wiley and Sons, New Delhi
4	Air Pollution	Stern	Academic Press Inc
5	Environmental Pollution Control Engineering	C. S. Rao	New Age International Publishers
6	A Text Book of Environmental Chemistry & Pollution Control	Dr. S.S. Dara and Dr. D.D. Mishra	S Chand & Company

8. SOFTWARE/LEARNING WEBSITES

- https://cpcb.nic.in/
- https://mpcb.gov.in/node
- https://parivesh.nic.in/
- https://www.web-ecology.net/
- http://soilhealth.ucdavis.edu/application/files/2015/4207/9078/BioremediationBook.pdf
- https://mausam.imd.gov.in/
- http://jalshakti-dowr.gov.in/
- https://www.4cleanair.org/wp-content/uploads/APTI/413Combined.pdf

PROGRAMME NAME : ADVANCED DIPLOMA IN ENVIRONMENTAL ENGINEERING

PROGRAMME CODE : EZ

SEMESTER : FIRST

COURSE TITLE : ENVIRONMENTAL MONITORING

COURSE CODE : 28016

1. RATIONALE

The subject deals with determination of physical characteristics of water, waste water, solid waste, air etc. It also deals with methods of chemical and environmental analysis. The monitoring of the pollutants by analytical & instrument techniques is imperative to understand specific pollutants as well as pollution levels to maintain good environment and keep the atmosphere safe for the living beings.

The professionals such as engineers and technologists will have to know and use various methods for monitoring the pollutants within specified limits as per the directives from appropriate authorities.

2. COMPETENCY

- Understand the concept of environmental monitoring and its importance in activities and services provided by various agencies, industries etc.
- Perform physical and chemical analysis of samples to determine the levels of pollutants.
- Know the methods of testing to ensure quality assurance given through standards.
- Implement the sampling process and its protocol.
- Select proper instrumental method for environmental analysis.

3. COURSE OUTCOMES

- To identify appropriate tests to analyse air, water, soil samples.
- Ability to calculate the results from the tests.
- Ability to measures quantities accurately.
- Ability to use the equipment /instruments efficiently.
- Tabulate the readings and results.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme												
				Theory							Practical					
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	4	8	-	-	-	-	-	-	-	50#$	25	50	25	100	50

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

Legends: ***L****-Lecture,* ***T*** *– Tutorial/Teacher Guided Theory Practice,* ***P*** *–Practical,* ***ESE*** *-End Semester Examination,* ***PA*** *- Progressive Assessment*

*@Internal Assessment, #External Assessment, *#Online Examination*

5. LIST OF PRACTICALS/ EXERCISES/ ASSIGNMENTS/ CASE STUDIES

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Demonstration of Sampling Techniques, Equipments and Instruments used for Water and Air Quality Monitoring.
2	Determination of pH of the given water and Oil sample.
3	Determination of Total Suspended Solids, Total Dissolved Solids and Total Solids of the given water sample.
4	Determination of Oil & Grease content of the given water sample.
5	Determination of Chemical Oxygen Demand of the given water sample.
6	Determination of Bio-chemical Oxygen Demand of the given water sample.
7	Determination of Hardness of the given water sample.
8	Determination of Chlorides in the given water sample.
9	Determination of Alkalinity in given sample.
10	Determination of Residual Chlorine in given water sample.
11	Determination of Hexavalent Chromium and total Chromium in the given water sample.
12	Determination of phosphates in given water sample.
13	Determination of Sulphates by Nephelometry.
14	Demonstration / Study on Flame Photometry (sodium/potassium).
15	Determination of NOx in the ambient air.
16	Determination of SO_2 in the ambient air.

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	pH meter
2	Heating mantle (Size: 100 ML TO 100 LTRS)
3	Hot plate (Temperature range 100 To 350 Degree Celsius)
4	Digital weighing machine (least count 0.01 g)

Sr. No.	Equipment Name with Broad Specifications
5	Digital Turbidity Nephelometer (Range 0 to 200 NTU)
6	*Digital Flame Photometer (Range 0-100ppm upto 250meq/l 1100 dil)
7	*High Volume Sampler (PM 2.5, PM 10, SO2, NOx,O3 & VOC)
8	*UV-Visible Spectrophotometer
9	Distillation Unit

* The corresponding experiments can be conducted as demonstration/ hands-on practical sessions in collaboration with an MOEFCC/ NABL accredited Environmental Laboratory.

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours
I	**Concepts of Environmental Monitoring and its relevance** • General - concepts, descriptions & applications • Water and Wastewater Monitoring • Ambient air quality monitoring • Workplace monitoring/ Indoor air quality monitoring • Fugitive emission • Process vents • Stacks/chimney • Soil Monitoring • Solid Waste Monitoring	08
II	**Sampling** • Sampling: Protocol and methods of sampling, sampling devices, • Preservation, storage and processing of air, water and soil, solid waste samples.	10
III	**Methods of determining physical Characteristics** Water: Potable water, industrial effluents, domestic effluents Solid: Municipal Solid Wastes, Hazardous Solid Wastes Study of : • Physical appearance • Color • Odor • Viscosity • Density /Specific gravity	10
IV	**Basic Methods of Chemical Analysis** • Titrimetric Analysis: Theory and applications of acid-base, complex metric,redox and precipitation titrations. • Gravimetry: Principle of gravimetric analysis. Precipitation methods. Drying and ignition of precipitates. Organic precipitants. • Applications.	12
V	**Instrumental Methods of Environmental Analysis** • Theory, instrumentation and applications of Conductometry,	12

Unit	Topic and Contents	Hours
	Potentiometry, Voltammetry. • Colorimetry and Spectrophotometry: Electromagnetic radiation Interaction of radiation with matter. Beer-Lambert's law. Colorimeters and Spectrophotometers.Applications.	
VI	**Advancement In Instrumental Monitoring & Analysis** • Principles, instrumentation and applications of Nephelometry and Turbidimetry, Flame photometry. Infra-Red spectroscopy, • Conventional microscopy and electron microscopy. • Chromatographic Methods in Environmental Analysis • Calibration of instruments. Quality assurance. Statistical interpretation and data validation • Advancement in instrumental monitoring and analysis- ICP-AES, MS, GC etc	12
Total		**64**

8. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Standard Methods for Examination Of Water And Wastewater	P.R. Sree Mahadevan Pillai	American Public Health Association
2	A Comprehensive Laboratory Manual for Environmental Sciences And Engineering	R.K. Trivedi	New Age International Publishers.
3	Chemical And Biological Methods for Water Pollution Studies	R. K. Trivedi, P. K. Goel	Environmental Publications
4	Handbook Of Water And Waste Water Analysis	Kanwaljit Kaur	Atlantic Publishers and Distributors
5	Soil And Air Analysis	S.K. Maiti	Jaipur ABD Publishers 2003

9. SOFTWARE/LEARNING WEBSITES

- Website of MOEF, GOI , New Delhi
- Website of MPCB
- Website of CPCB
- https://unece.org/environmental-monitoring

PROGRAMME NAME : ADVANCED DIPLOMA IN ENVIRONMENTAL ENGINEERING
PROGRAMME CODE : EZ
SEMESTER : FIRST
COURSE TITLE : POLLUTION CONTROL AND WASTE MANAGEMENT
COURSE CODE : 28017

1. RATIONALE

Control of pollution & waste management is vital part of reducing the waste generation air, solid and liquid. Study of the new Techniques Recycle, Reuse, Re-process for reducing the waste.

Study of waste liquid process to convert it from hazardous to less hazardous like Effluent Treatment plant, Common Effluent Treatment Plant.

Know Solid waste management for Municipal Solid Waste, Bio-Medical Waste, Plastic and "E" Waste etc., Radio Active Waste to understand their impact on environment. Also, study method of Control of Pollution.

2. COMPETENCY

- Understand the concept of wastewater management and its importance in activities and services provided by various agencies, industries etc.
- Perform physical and chemical analysis of sample of waste (Solid, Liquid and Gas/ airborne particles) to determine the levels of pollutants.
- Know the methods of testing to ensure quality assurance given through standards.
- Implement the sampling process and its protocol.
- Select proper instrumental method for environmental analysis {Measurable}.
- Important ROLE of ISO 50001 : Energy Management System for Environment Management and Co- align with ISO 14001

3. COURSE OUTCOMES

- Dissemination of information and knowledge of Hazardous Waste management
- Develop management & organizational tools for successful planning & operation of effluent treatment plant projects.
- Develop management ingredients including cost analysis, statistical analysis, organizational culture, and entrepreneurial development.
- Understands the need of personal safety equipment and need for their uses.
- Key role as member of team for ISO 50001 audit.
- Project Coordinator for Green Building Technology and Methodology to apply techniques.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme												
				Theory							Practical					
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	4	8	-	-	-	-	-	-	-	50@$	25	50	25	100	50

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends: L**-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*

*@Internal Assessment, #External Assessment, *#Online Examination*

5. LIST OF PRACTICALS/ EXERCISES/ ASSIGNMENTS/ CASE STUDIES

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Study of design and process of Wastewater treatment plant.
2	Study of various physical and chemical, biological parameters of Effluent treatment plant (pH, Color, Temperature, BOD, COD, MLSS etc.)
3	Prepare Study report on Ambient environment monitoring.(SCHEDULE VII, Rule 3(3B), The Environment Protection Rules 1986
4	Evaluate and study of Hazardous waste (Solid Sludge) Manifest form of Industry under The Hazardous Waste Management and Trans boundary Management Rule 2016)
5	Stack Monitoring of Boiler and note down the parameter like CO, CO2, NOX, SOX discharging via stack
6	Measurement of Incoming Untreated and Outgoing Treated effluent Flow. Compare with necessary balance.
7	Study of Membrane System for Secondary treatment of treatment effluent.
8	Study and Prepare (FORM V : ENVIRONMENT STATEMENT FOR THE FINACIAL YEAR ENDING THE 31 ST MARCH) under The Environment Protection Rules 1986
9	Prepare suggestion-based report for Recycle and Reuse of wastewater.
10	Study of the design and structure of "REVERSE OSMOSIS SYSTEM"
11	Calibration of water meter
12	Study report on design and construction of common water effluent treatment plant
13	Study of Membrane System (uses for treated effluent for recycle)
14	Study of the Consent to operate of any industry and prepare report.

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
15	Study of the design and construction of Sewage Treatment Plant
16	Case study of Green Building Design concept (Physical visit to site)

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	Digital Thermometer
2	Flow meter (Capstan make size 1")
3	*Flue Gas Analyser (Testo Make)
4	BOD incubator

*The corresponding experiments can be conducted as demonstration/ hands-on practical sessions in collaboration with an MOEFCC/ NABL accredited Environmental Laboratory.

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours
I	**Water and Wastewater Treatment- I** • Quality requirements of water for Human, Habitat, and different industrial use. Treatment with UV, H_2O_2, Ozonization. Examples of industries with specific water quality requirements: pharmaceutical industries, General scheme for the treatment of water for drinking purpose. • Characteristics of municipal sewage and various industrial wastewaters. Planning for wastewaters treatment and disposal. Preliminary, primary, secondary (Biological and chemical) and tertiary treatments. • Unit processes in treatment of water and wastewater, • Physico-chemical treatment processes: Screening, grit removal, aeration/stripping, oil removal, coagulation and flocculation, sedimentation, filtration, floatation, equalization, neutralization, oxidation-reduction, chemical precipitation, disinfection, adsorption, softening, desalination/demineralization, membrane processes.	08
II	**Water and Wastewater Treatment- II** • **Biological treatment processes- aerobic processes:** Suspended floc type- the activated sludge process. Extended aeration. Aerated lagoons. Waste stabilization ponds. Attached film type and the rotating disc biological contact system, the trickling filter process. • **Biological treatment processes- anaerobic processes:** Flow through systems and contact systems. UASB reactors and modifications. Expanded- bed and fluidized- bed reactors.	08

Unit	Topic and Contents	Hours
	• **Nature, type and characteristics of sludge of different origins:** Sludge treatment and disposal. Processing of sludges- conditioning, thickening, de-watering, drying, incineration, and disposal. Land application. Sludge stabilization. Radiation sterilization. Digester gas utilization.	
III	**Water and Wastewater Treatment- III** **Concept of WTP** • Concept of Common Effluent Treatment Plant (CETP), their importance and advantages, role in waste water treatment, Unit processes involved. Designing aspects of CETPs. • The nitrification and denitrification processes for nitrogenous effluents, removal of phosphates, cyanide and heavy metals from wastewaters. • Wastewater treatment for the effluents from major industries such as fertilizers, pharmaceuticals, petroleum refining and petrochemicals, pesticides, pulp and paper, sugar, textiles and power generation. Comparison of end-of-the pipe treatment and in plant treatment. Waste minimization and resource recovery as part of process control. • Effluent discharge standards, concepts of dilution in receiving waters, industry specific, minimum and national standards. • Basics of Advance techniques in water/waste water treatments: Tertiary treatment, Reverse Osmosis • Concept of Water Treatment Plant • Salient features of The Water (Prevention and Control of Pollution) Act and rules and it's latest amendments • Salient features of The Water (Prevention and Control of Pollution) Cess Act and it's latest amendments	**12**
IV	**Air Pollution Management** • Various types of Air emissions. Characteristics and composition of gaseous emissions at the point of origin from major industries- fertilizers, oil refining, chemical- petrochemicals, coal/oil/gas-fired power plants/boilers and smelters. • Gravitational settling chambers; cyclone separators; fabric filters; electrostatic precipitators; wet collectors and scrubbers. Absorption in liquids, adsorption on solids. Combustion: flaring, thermal incineration, catalytic oxidation. Control of other gaseous pollutants, odors, VOCs, oxides of Sulphur and nitrogen emissions. • Indoor Air quality management, principles and control measures, steps for improving indoor air quality. • Auto-exhausts, its components. Control of auto-exhausts emissions, emission specific control options; Importance of good maintenance and driving habits. Alternative fuels. • Salient features of The Air Act and rules and it's latest amendments,. National Clean Air Programme (NCAP)	**12**
V	**Waste Management I** • Management of municipal solid waste (MSW): Sources of generation, physical composition and characteristics. Methods of sampling, Proximate and ultimate analysis. Collection, storage, transport and	**12**

Unit	Topic and Contents	Hours
	disposal methods; Open-dumping and sanitary landfills. Reduction, reuse and recycling of materials. Optional technologies for processing of MSW: Incineration, palletization, gasification, pyrolysis. • Salient features of The Municipal Solid Wastes (Management & Handling) Rules and it's latest amendments • Management of Plastic Waste: Sources of generation, composition and characteristics. Collection, storage, transport and disposal methods. • Salient features of The Plastic Waste (Management and Handling) Rules and its latest amendments.	
VI	**Waste Management II** • Hazardous Waste: Sources and characteristics, Classification. Health and environmental effects. Safe storage, transport and storage of hazardous waste. Stabilization and disposal of hazardous waste. Criteria for selection of secured and unsecured landfill disposal sites. • Salient features of The Hazardous Wastes (Management And Handling) Rules and the latest amendments • Biomedical Waste Management: Definition, types, sources and categories, generation in different clinical areas in hospitals. Classification, segregation and color-coding for storage containers. Code of practice for proper handling and management of biomedical wastes. Treatment of biomedical wastes: Disinfection/Sterilization, autoclaving, microwave treatment and incineration. Disposal methods. Preventive and control measures for biomedical wastes. • Salient features of The Bio-Medical Waste (Management And Handling) Rules and it's latest amendments • Radioactive Waste: Sources, Classification, Health and safety aspects. Management of radioactive waste. • Salient features of The Atomic Energy Act and Rules and it's latest amendments	12
Total		**64**

8. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Environmental Studies	Anindita Basak	Pearson
2	Waste to energy (Solution to Solid Waste Problem)	Brent M Voelker	--
3	General Aspects of Energy Management	--	Bureau Of Energy Efficiency
4	Concepts of Ecology	Kormondy E. J	TMH
5	Environmental Biotechnology	Alan Scragg	Oxford University Press.

9. SOFTWARE/LEARNING WEBSITES

- https://www.unfcc.int
- https://parivesh.nic.in/
- https://www.bee-india.nic.in/ECACT/ecactpdf.zip
- http://www.rise.org.au
- http://indianecologicalsociety.com/society/journal/
- https://www.india.gov.in/topics/environment-forest
- https://www.indiawaterportal.org/articles/bioremediation-its-applications-contaminated-sites-india-state-art-report-ministry
- http://pdhengineers.com

PROGRAMME NAME : **ADVANCED DIPLOMA IN ENVIRONMENTAL ENGINEERING**

PROGRAMME CODE : **EZ**

SEMESTER : **FIRST**

COURSE TITLE : **ENVIRONMENTAL AND INDUSTRIAL HYGIENE, OCCUPATIONAL HEALTH AND SAFETY**

COURSE CODE : **28018**

1. RATIONALE

To holistically understand the objectives of health hygiene and safety aspects, to achieve prevention & control of Industrial and other areas including the air borne chemicals, chemical & physical stresses, and use of PPE (Personnel Protective Equipment). The study of this subject is important. This study will help students in performing their tasks in world of work.

2. COMPETENCY

- Able to identify appropriate tests to analyze air , water samples for pollution.
- Able to calculate the results from tests
- Ability to measure quantities accurately
- Ability to use the equipment/instruments efficiently
- Tabulate the reading and results.

3. COURSE OUTCOMES

- Understand the Importance of Industrial Hygiene
- Know the aspects to be covered in monitoring the work environment.
- Know the Safety rules and concepts of Chemical industries.
- Understand the need of personal protective equipments and need for their use.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
				Theory							Practical						
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	-	2	6	-	-	-	-	-	-	-	50#$	25	50	25	100	50	

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends:** L-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*

*@Internal Assessment, #External Assessment, *#Online Examination*

5. LIST OF PRACTICALS/ EXERCISES/ ASSIGNMENTS/ CASE STUDIES

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Study of Sound level meter
2	Study of Noise dosimeter
3	Study of Lux meter
4	Measurement of Illumination level at work place (Standard of level required as per The M.F.R 1963, Rule 35,Sched A, Sr No 3)
5	Study and Operation of Sling psychomotor.
6	Determination of Airborne dust by gravimetric method
7	Determination of air sampling equipments and its calibration process.
8	Determination of Ammonia (NH3) in air by Colorimetric method
9	Determination of SO2by West and Geake method.
10	Determination of Chlorine by Calorimeter.(Methyl Orange method)
11	Study of Various routes of human exposure with toxic chemical and substances and its effects.
12	Identification of various physical hazards and control prevention of Heat, Noise and Vibration.
13	Study of Metallic substance Hazards and control prevention method for Beryllium, Lead, Phosphorus.
14	Study of Gas & Chemical Hazards and control prevention method for Chlorine (Cl_2), Ammonia (NH_3), Benzene (C_6H_6).
15	Biological estimation to determine and diagnosis of occupational diseases.(routine investigations parameters and Normal +Threshold limits of substances in blood)
16	List down the notifiable diseases and hazardous operation as per schedules in The factory Act 1948
17	Study of plant layout design for chemical Mfg. factory.
18	Classification of Personal Protective Equipments (Respiratory & Non Respiratory)

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	Noise meter
2	Lux Meter
3	*Gas Detector

*The corresponding experiments can be conducted as demonstration/ hands-on practical sessions in collaboration with an MOEFCC/ NABL accredited Environmental Laboratory.

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours
I	**Industrial Hygiene** • Definition, scope, significance and applications. • Occupational environmental stresses. ▪ Physical stresses- Noise, vibration, illumination, ventilation, heat stress. ▪ Chemical stresses- Toxic chemicals, hazardous chemicals, flammable chemical, explosive chemicals, etc. Inhalation and ingestion risks.	08
II	**Airborne Chemicals** Dust or aerosols (respirable, non-respirable, inhalable and total dust), gases, fumes, vapours, mist or smoke. Concept of threshold limiting values (concentration) TLVs, Time Weighted Average (TWAs); Short term exposure limits (STELs); International and National regulatory agencies like ACGIH, OSHA, Factory Act 1948 & 1987 amendment. Concepts of Minimum National Standards (MINAS), suggested by organization like CPCB.	10
III	**Monitoring of Work Environment** Identification of contaminants. Sampling strategies: Monitoring methods, protocol on procedures. Sampling of airborne contaminants, viz dust, gases, vapors, mists etc on workplace environment and analysis method for quantification- Instrumental and manual methods. **Report writing:** data presentation, interpretation of results, discussion, conclusion and suggestions/ recommendations for appropriate emission control.	10
IV	**Biological Monitoring** • Biological indicators: metabolites and transformed chemicals in biological materials such as blood, urine, body fluid, faeces, etc. • Significance of bio monitoring; Biotransformation: mechanism of chemical absorption, toxicity evaluation, detoxification. Biological TLVs. • **Control Measures** Work environment control measures: Substitution, isolation, ventilation, local exhaust system, wet methods and engineering control measures. Housekeeping and maintenance. Modification of the processes and operation. Treatment of the waste and disposal in work places. Process and product specific control measures. Control of noise-technologies. Importance of SIP.	10
V	**Occupational Health** • Toxicology: Basic principles of toxicology assessment including LD50 and LC50; In vitro and in vivo studies. Natural detoxification-biochemical mechanism. Basic hazards of airborne chemicals, route of entry into human body, mode of action, metabolism, dose-response relationship. Bio chemical action of toxic substances and TLVs. • Exposure to toxic chemicals, acute and chronic effects, occupational	12

Unit	Topic and Contents	Hours
	disorder; allergens; mutagenicity, teratogenicity and carcinogenicity. • Occupational diseases: Pneumoconiosis, silicosis, asbestosis, byssinosis, metal poisoning (lead, mercury, manganese, copper etc.) • Notifiable diseases; possible symptoms and target organs. • Synergistic effects: enhancement in toxic effects to extraneous factors, reversible and irreversible effects, synergism.	
VI	**Safety and Personal Protective Equipment** • **Safety in Chemical Industry** Definition and concepts; Criteria for siting and layout of chemical plants, precautions in the processes and operations involving explosives, flammables, toxic substances, dust, vapors, cloud formation and combating. Chemical compatibility considerations. Safety precautions for transportation of hazardous chemicals. Handling and storage of hazardous chemicals. Safety in pipelines and color coding. Risk assessment and on site and off site emergency planning. Safety audit in chemical industry. Accidents and unusual occurrences reporting. • **Personal Protective Equipment** Respiratory Personal Protective Equipment (RPPE) & Non-Respiratory Personal Protective Equipment (NRPPE): Selection, use, care and maintenance of Non-Respiratory protective equipment • **NRPPE:** Head protection, ear protection, face and eye protection, hand protection, foot protection and body protection. Quality control of protective equipments. Periodic medical check-ups of occupational workers and information transparency.	**14**
Total		**64**

8. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Environment, Health and Safety Handbook	Levi Strauss & Co.	Levi Strauss & Co.
2	Occupational Health, Safety, andHygiene	Tekele Tadese , BSc Mengesha Ademassu, M.D. and Kebede FarisM.Sc.	University of Gondar
3	Introduction to Health Education	Meseret Yazachew Yihenew Alem	Initiative, The Carter Center, the Ethiopia Ministry of Health,and the Ethiopia Ministry of Education November 2002, in collaboration with the EthiopiaPublic Health Training
4	Frank R Spellman	Industrial Hygiene Simplified	e book

9. SOFTWARE/LEARNING WEBSITES

- https://outdoorindustry.org/pdf/SustainabilityEHHandbookLSandCO.pdf.
- https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/env_health_science_students/ln_occ_hlth_sfty_hygiene_final.pdf.
- https://hsseworld.com/e-books-industrial-hygiene-simplified/.

PROGRAMME NAME : **ADVANCED DIPLOMA IN ENVIRONMENTAL ENGINEERING**
PROGRAMME CODE : **EZ**
SEMESTER : **SECOND**
COURSE TITLE : **ENVIRONMENTAL MANAGEMENT**
COURSE CODE : **28208**

1. RATIONALE

This paper supplements the knowledge gained in earlier semester and prepares the student to take up the actual working of different projects connected with different natural resources & eco- systems. Student gains analytical skills concerned with cost items, learns to handle labour & other organizational components & becomes capable of preparing reports & organizing & analyzing data & communicating results to appropriate authorities & / or agencies. Project & field work exposes the student to realities in the field.

2. COMPETENCY

Auditing, Compliance & amp; Strategic planning, Corporate HSE support, Crisis management and emergency response, industrial EHS responsibilities, hygiene and toxicology, Regulatory affairs, Implementation of Best Practices, Training and Deployment

3. COURSE OUTCOMES

- Dissemination of information and knowledge of environmental management
- Develop management & organizational tools for successful planning & operation of environmental projects.
- Develop management ingredients including cost analysis, statistical analysis, organizational culture, and entrepreneurial development.
- Understands the need of personal safety equipment and need for their uses.
- Take up the actual challenges in the field of planning for a development / conservation / restoration project & implement it.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme											
				Theory						Practical					
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	-	-	4	1.5	70*#	35	30*	00	100	50	-	-	-	-	-	-

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends:** L-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** – Practical, **ESE** - End Semester Examination, **PA** - Progressive Assessment*

*@Internal Assessment, #External Assessment, *#Online Examination*

5. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours	Marks
I	**Principles of Environmental Management** Environmental Management perspectives: Development and environmental linkages. Environmental concern in India. The need for sustainable development. Actions for environmental protection: National and international initiatives, ISO framework, ecosystem approach, emerging environmental management strategies, Indian initiatives. Environmental Management tools, the role of professionals in environmental management. Emerging basis of environmental management in 21st century, e. g. fresh-water availability global crisis. Case studies: International Conventions and Treaties: Stockholm Conference 1972, Rio Earth Summit 1992, Montreal Protocols, Core Publication Agenda 21, United Nations Framework Convention on Climate Change, COP 26/27 Prominent NGOs and their contributions. International organizations; World Environment Day- Concept and themes.	**10**	**10**
II	**Policies and Legal Aspects of Environmental Management and Legislations** Salient Features of -- Environmental Protection Acts, Rules and amendments thereof. Philosophy and major provisions of Act. Indian Forest Policy 1987. Policy Statement on Environment and Development and on Abatement of Pollution. The National Tribunal Bill 1992; The Forest Act, 1948. The Wildlife (Protection) Act, 1972. Ministry of Environment and Forest-notifications related to hazardous microorganisms and genetically modified organisms or cells. EIA Notification and amendments, MSIHC Rules and amendments, Environmental Clearances and Prevention & Control of Pollution Acts. Projects requiring clearances. Guidelines for industries. Statutory obligations of industries. Public Liability Insurance Act, 1991. Coastal Zone Regulations 1991 and modifications thereafter. Pollution Control Boards and their functions. Legislation for control of noise pollution. Judicial interventions in environmental management.	**10**	**12**
III	**Environmental Hazards and Disaster Management** Introduction, definitions, Natural hazards; nature, causes, impacts and occurrences. Earthquakes, volcanic activity, landslides, cyclones, floods, droughts, forest fires; their mitigation. Industrial and technological hazards: types and causes of industrial accidents- physical, chemical, biological, electrical. Nature of accidents: fire, explosion, toxic release and dispersion. Disaster Management: Components of disaster	**10**	**12**

Unit	Topic and Contents	Hours	Marks
	management plan- on site and off site emergency plans. Technical hazards control system-incident reduction, Incident management. Techniques of hazards assessment: PHA, HAZOP, HAZAN, Maximum Credible Accident Analysis (MCAA)		
IV	**Environmental Statement and ISO series** Evolution of and code of practice for environmental audit. Types of environmental audits: Objective-based and client-driven types. Waste audits and pollution prevention assessments. Liability audits and site assessment. General audit methodology and audit process: Introduction, the basic structure of an environmental audit program. General steps in an environmental audit procedure. Overview of element of audit processes: audit protocols (why, who, what and how). Audit certification and authorization. **14000 Series Architecture. ISO 14001** EMS Specification Standards. Planning and Implementation of EMS Conforming to ISO 14001: Guidelines. Benefits of Implementing ISO 14001. The adoption of ISO 14001 series. **ISO 50001:** Key elements of Energy Management System, Benefits of Implementing ISO 50001.	12	12
V	**EIA, LCA, Environmental Modeling & Design** • **Environmental Impact Assessment (EIA)** Concept of EIA. Its scope, EIA study procedures, requirements for the same. Resources needed for EIA. Report preparation. Legal aspects. • **Life Cycle Assessment as an EM tool** Evolution of Life Cycle Assessment (LCA). Different applications of LCA. • **Procedure for LCA** Defining goal and scope, preparation of Life Cycle Inventory, assessment of environmental impact, and evaluation of environmental profiles. Stages in LCA of a process/product Profile. Cradle to Grave approach. • **Environmental Modeling and Design** **Environmental Modeling:** Applications of remote sensing and Geographical Information System (GIS) in environmental management. Environment quality monitoring. **Environmental Design:** Principles of Environmental Design (ED). ED of manufactured products, ED considerations in product life stages, tools for ED of Products. Examples of environmental design. Concept of eco-label. • **Brief introduction to the Green Building Concept (GBC).**	14	12

Unit	Topic and Contents	Hours	Marks
VI	**Environmental Economics** Economics and finance: An exposition, Environmental costs and benefits. Valuation of environmental impacts: approach, valuation techniques, valuating environmental amenities. Environmental Economics based assessment. Ecological economics. Market based instruments for pollution controls. Economics incentives such as tax exemption for pollution control and sustainable development practices.	08	12
Total		**64**	**70**

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Principles of Environmental Management	10	02	04	04	10
II	Policies and Legal Aspects of Environmental Management and Legislations	10	02	05	05	12
III	Environmental Hazards and Disaster Management	10	02	05	05	12
IV	Environmental Statement and ISO series	12	02	05	05	12
V	EIA, LCA, Environmental Modeling & Design	14	02	05	05	12
VI	Environmental Economics	08	02	05	05	12
Total		**64**	**12**	**29**	**29**	**70**

Legends: *R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)*

Note*: The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

7. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

The suggested list of case studies / Tutorials is given below:
Current environmental concerns:

- Antarctica and ozone, ozone depletion, global warming and climate change, climate adaptation, acid rain, soil erosion and conservation, loss of tropical rainforest, sustainable development, biodiversity, biopiracy, population explosion, Gir forest.
- Air pollution episodes; sensitive and heritage area concepts (The Taj Trapezium).
- The major river water systems management in India.
- Desertification, eco-disaster of deforestation worldwide.
- National Green Tribunal - National Green Tribunal Act, 2010 and land-mark NGT Judgements (Example – where Polluter Pays' principle invoked, Complete prohibition on open burning of waste on lands, Victory for Birds, Massive Hydro Power Project Lose)

8. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Environmental Law and Policies in India	Shyam Divanand Armin Rosencranz	Oxford University Press,New Delhi
2	Environment Auditing	A. K. Shrivastava	APH Publishing
3	Environmental Impact Assessment	Larry W. Canter	McGraw Hill
4	Environmental Impact Assessment: Theory and Practice	Anji Reddy	BS Publication
5	Lees' Process Safety Essentials: Hazard Identification, Assessment and Control	Mannan and Sam	Elsevier Science

9. SOFTWARE/LEARNING WEBSITES

- http://moef.nic.in/index.php
- https://moef.gov.in/en/rules-and-regulations/environment-protection/
- http://environmentclearance.nic.in/
- https://blog.ipleaders.in/ngt-judgments/
- https://www.greentribunal.gov.in/
- https://cpcb.nic.in

PROGRAMME NAME : ADVANCED DIPLOMA IN ENVIRONMENTAL ENGINEERING

PROGRAMME CODE : EZ

SEMESTER : SECOND

COURSE TITLE : PROJECT

COURSE CODE : 28068

1. RATIONALE

PROJECT work / activity is assigned to the student in all Advanced Diploma programmes streams. The purpose and aim to create awareness about the industry culture and professional working and management practices followed in the industries.

In should develop professional creativity in the students before they enter into industry/organization work and make them competent to promote and develop working attitude among them to create unique product.

By exposing and interacting with the real life industrial setting, student will appreciate and understand the actual working of an industry, best practices adopted in industry and other requirements in the industry or their chosen subject title for project.
The industrial needs such as the soft skills, life skills and hands-on practices are intended to be inculcated in the students through this training. This short association with the industry will be instrumental in orienting the students in transforming them to be industry ready after completion of diploma programme.

2. COMPETENCY

This course is intended to develop the following competencies:

- **Soft Skills :** Communication, Presentation, Data designing ,MIS
- **Life Skills:** Time management, Safety, Knowledge building skill , theory integration with practices and practical methodology followed in organization.
- **Hands-on Practices:** Process studies, Standard Practices and Procedures with respect to Quality aspects considered for good weightage of project.

3. COURSE OUTCOMES

The Project activity is intended to acquire the competencies as mentioned above to supplement those attained through several courses up to second semester of the program:

- Communicate effectively (verbal as well as written) to execute the work.
- Prepare the project report with necessary content weightage for selected title /area.
- Identify and understand Environmental hazards and their control measures.
- Standard practices of Environment management Audit and monitoring day-to-day parameters.
- Exercise time management and safety in the work environment.
- Work in teams for successful completion of projects assuring quality.

- Positive and Negative points with solution and Suggestion especially for negative compliance

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme												
				Theory							Practical					
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
-	-	8	8	-	-	-	-	-	-	-	50#	25	50	25	100	50

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends: L**-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*

*@Internal Assessment, #External Assessment, *#Online Examination*

5. IMPLEMENTATION STRATEGY

Candidate should be assigned Project preferably individually or if at all not possible can form a group of maximum 3 members. Every candidate must maintain the weekly progress diary and the guide should review the progress and sign the diary regularly.

Every candidate has to submit **Synopsis Report** (of pages not more than 10) and deliver Two Presentations for the completion of the Project.

First Presentation of Synopsis - to the Internal Guide tentatively during Third Week of the Academic Term.

Second Presentation on complete Project - to be given to the Internal Guide during Second Class Test schedule.

Contents of the Synopsis - It should include the following points

1. Cover Page of the Synopsis (Title of the Project, Student and Guide Details, Institute Name, Academic Year, Maharashtra State Board of Technical Education, Mumbai)
2. Index
3. Introduction
4. Need of the Project and Objectives
5. Problem Definition
6. Methodology
7. Action Plan

Evaluation of Practical-PA will be the average of two presentations, synopsis report and weekly progress diary maintained by the candidate.

There should not be any sort of typographical, diagrammatic and any other mistake/s in the final bound copy of the project report submitted by the candidate.

PROJECT REPORT CONTENTS

The Project report should essentially consists of the following details.

- COVER PAGE OF THE PROJECT
- CERTIFICATE FROM THE INSTITUTE
- ACKNOWLEDGEMENT
- TABLE OF CONTENTS
- ABSTRACT
- INTRODUCTION
- METHODOLOGY OF PROJECT
- RESULTS
- CONCLUSION AND FUTURE SCOPE
- ABOUT THE ORGANISATION / COMPANY (IN CASE OF INDUSTRY BASED PROJECTS)
- REFERENCES / BIBLIOGRAPHY

GUIDELINES FOR PREPARING THE PROJECT REPORT

Project work is a basic requirement for the award of Advanced Diploma. Project should be prepared based on any one of the subjects of the Programme. The project work should be comprehensive and cover all aspects of the Environment Management Principal and Practices in industry, Society as well as Social, Public and Corporate Community.

COVER PAGE OF THE PROJECT

The Cover Page of the Project Report must include Title of the Project, Student and Guide Details, Institute Name, Academic Year, Maharashtra State Board of Technical Education, Mumbai.

CERTIFICATE FROM THE INSTITUTE

Certification from Project Guide, HOD, Principal and final signature of External Examiner during final examination.

ACKNOWLEDGEMENT

It should appear on the third page and the report writer should acknowledge the guidance provided by the project guide. Here the author may also acknowledge other persons who might have rendered help or supplied the required data or information for completion of the project. It should be brief and crisp. Generally, one page should suffice for acknowledgement.

TABLE OF CONTENTS

It must consist column heading as Chapter No., Name of the Chapter and Page Number.

ABSTRACT

Abstract should describe the entire project work with its aim, objectives and methodology and conclusion. The abstract should be limited to one or two pages.

INTRODUCTION

Give brief description of need, significance and applications of the Project. It is recommended to limit the description to about 2 to 5 pages.

METHODOLOGY OF PROJECT

This is the most important part of the project report and forms the main body of the project report. It needs very comprehensive coverage of all aspects of safety in the plant, industrial hygiene, environmental conservation, safety in storage and transportation, etc. It will usually require about 60 to 100 pages. Write-up should include the details of following areas applicable to the topic of your project:

- Occupational health, safety and environment policy of the company and its implementation
- Safety organization.
- Role of management in promoting healthy environment and striving for continual improvement.
- ISO 14001- 2015 Model and its application for an organization towards achievement of business targets globally.
- Accidental exposure of toxic substances in environment and incidents reporting system
- Accident/incident analysis (using data of previous five years at least)
- Case-studies (discuss at least five cases of different types of issues)
- Selection and training of employees
- Induction and training of employees and contractor personnel
- Health and hygiene.
- Principals and attitude for Energy conservation attributes.
- Safety in transportation and training of drivers
- Trade union and its role in promoting Environment , health and safety
- Plant layout
- Facilities and services
- Storage and handling of chemicals, Hazardous substances.
- Built-in safety measures
- Instrumentation for safety of plant and personnel
- Fire prevention and fire-fighting measures
- Housekeeping
- Pollution control measures.
- Opportunities for Energy conservation.
- Last 5 years Energy Conservation projects completed/ Study done.
- Various Standard Operating procedures.

- Role and Promotional contribution of an organization towards reducing Global warming effects.
- Operation and study of Waste Water treatment Plant.
- Water Balancing Concept.
- Ambient environment monitoring as well as Stack monitoring data study.
- Battery limits of solid, Liquid and vapor/gases discharge as per MPCB Consent.
- Solid Hazardous waste management discharge process as per relevant statutory.
- Preventive maintenance
- Health, safety and environment audits.

Relevant information and data presented in the form of tables and graphs (e.g., graphs for injury frequency rates, severity rates, frequency-severity indices, incident rates, fire statistics, etc.), accident/incident analysis, work permit form, accident/near-miss incident report form, medical attention form, block diagrams, plant layout, relevant photographs, MSDS, etc., which are required to supplement your project report, should be included at the end as annexures with appropriate references in the main text of the project report. If an annexure is of more than one page, it should be provided with page numbering. Page numbering should be done individually for each annexure.

RESULTS

It should contain experimentation result of the Project.

CONCLUSION AND FUTURE SCOPE

Based on the project work, draw inferences and mention future scope. The future scope should be specific, relevant and practically implementable.

ABOUT THE ORGANISATION / COMPANY (IN CASE OF INDUSTRY BASED PROJECTS)

Should mention Organizational Structure, Product / Services (Limit to 1 to 2 pages).

REFERENCES / BIBLIOGRAPHY

Mention books, research papers, websites referred in the report in this section.

PROJECT REPORT FORMAT

Paper Size	-	A4
Printing	-	Only on one side of the sheet
Line Spacing of Paragraph	-	1 ½
Font Face	-	Times New Roman
Font Size	-	12 for Normal text, 14 for Sub-headings and 16 for Headings
No of Project Report copies	-	Two
Binding	-	Hard bound copies with Black cover (Golden Embossing)

PROGRAMME NAME : **ADVANCED DIPLOMA IN ENVIRONMENTAL ENGINEERING**

PROGRAMME CODE : **EZ**

SEMESTER : **SECOND**

COURSE TITLE : **INDUSTRIAL TRAINING**

COURSE CODE : **28069**

1. RATIONALE

Industrial training course is introduced to Advanced Diploma in Environmental Engineering programme with the aim to imbibe the industry culture and professional practices in the students before they enter into world of work. By exposing and interacting with the real life industrial setting, student will appreciate and understand the actual working of an industry, best practices adopted in industry and other requirements in the industry or their chosen field of training. The industrial needs such as the soft skills, life skills and hands-on practices are intended to be inculcated in the students through this training. This short association with the industry will be instrumental in orienting the students in transforming them to be industry ready after completion of diploma programme.

2. COMPETENCY

This course is intended to develop the following competencies:

- **Soft Skills** i.e. Communication, Presentation and others.
- **Life Skills** i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others
- **Hands-on Practices** i.e. Designing, Laboratory Studies, Implementation and Quality Assurance aspects.

3. COURSE OUTCOMES

The industrial training is intended to acquire the competencies as mentioned above to supplement those attained through several courses up to second semester of the program:

- Communicate effectively (verbal as well as written) to execute the work.
- Prepare the industry report of the skills acquired and executed work.
- Identify and understand Environmental hazards and their control measures.
- Exercise time management and safety in the work environment.
- Work in teams for successful completion of projects assuring quality.
- Work on case studies/live projects

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
				Theory							Practical						
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	18	18	-	-	-	-	-	-	-	100#	50	100	50	200	100	

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*

1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends: L**-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*

*@Internal Assessment, #External Assessment, *#Online Examination*

5. GENERAL GUIDELINES FOR INDUSTRIAL TRAINING

The Industries/Organizations can be Government/Public limited/Hospital/or Private family enterprises.

- **Duration of Industrial Training:** 8 weeks in Final Semester as per the credits of the programme
- **Training Area:** Students should be trained in large and medium/ small scale Industry / Organization/ Effluent treatment plant/ Solid Waste Management Facilities/ Environmental Consultancies / Environmental laboratories.
- **Skill Knowledge Partner** : To be identified by the Institute as per their programme areas.

Note: If Student is employed in any of the above sector, he shall opt for training in his own organization.

6. EXPECTATIONS FROM SKILL KNOWLEDGE PARTNER (SKP)

Helping institute in developing the following competencies among students

- Soft Skills i.e. Communication, Presentation and others.
- Life Skills i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others
- Hands-on Practices i.e. Shop floor Implementation and Quality Assurance aspects.

7. ROLE OF PARENT DEPARTMENT OF THE INSTITUTE

- Collecting information about Industry / Organization available for training along with capacity.
- Institutions have to enter into MOU with number of SKPs(Industries/ Organizations) for accommodating all the enrolled students for the mandatory
- Student and mentor allocation as per the slots available for in-.plant training (Desirable mentor- student ratio is 1:15).
- Communication with Industry / Organization available for training along with capacity and its confirmation
- Student enrollment for training.
- Issuing letter to the Industry / Organization for the training along with details of students and mentors.
- Principal/ HOD/ Faculty should address students about industrial safety norms, rules and discipline to be maintained in the Industry/ Organization during the training before relieving students for training.

- The faculty member during the visit to Industry/ Organization will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.
- Mentors to carry out progressive assessment of the students during the training through Progressive Assessment (PA).
- End Semester Examination(ESE) assessment by mentor along with Industry / Organization expert as external examiner.

8. ROLES AND RESPONSIBILITIES OF THE STUDENTS

Following should be informed to students in the letter deputing them for the training, an undertaking for this should also be taken from them

- Students would interact with the mentor to suggest choices for suitable Industry / Organization. If students have any contact in Industry / Organization (through their parents, relatives or friends) then same may be utilized for securing placement for themselves and their peers.
- Students have to fill the forms duly signed by authorities along with training letter and submit it to training officer in the industry on the first day of training. Student should also carry with him/her the Identity card issued by institute during training period.
- He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the Industry / Organization and safety procedures to be followed. Student is expected to observe these rules, regulations, procedures.
- Students should know that if they break any rule of industry or do not follow the discipline then industry can terminate the training and send back the student.
- It is the responsibility of the student to collect information from Industry / Organization about quality assurance methods/specifications of machines and raw materials/maintenance procedures/ production planning/work ethics/professional practices/organizational structure etc.
- During the training period students have to keep daily record of all the useful information in Log book
- Maintain the Diary/Logbook and get it signed from mentor as well as Industry / Organization Training in-charge.
- In case they face any major problem in industry such as an accident or any disciplinary issue then they should immediately report the same to the institute.
- Prepare final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from mentor as well as Industry / Organization training in-charge.

9. FORMAT FOR TRAINING REPORT

Following is the suggestive format for the training report, actual format may differ slightly depending upon the nature of Industry / Organisation. The training report may contain the following

- Title page
- Certificate
- Abstract
- Acknowledgement

- Content Page

Chapter 1. Organizational structure of Industry / Organisation and General Lay Out
Chapter 2. Introduction of Industry / Organisation (Type of products and services, history, turn over and number of employees etc.)
Chapter 3. Types of major equipment/instruments/ machines used in industry / laboratory with their specification, approximate cost and specific use and their routine maintenance.
Chapter 4. Manufacturing Processes along with production planning and control methods and standard Operating procedures.
Chapter 5. Understanding and analyzing Environmental parameter (liquid, gas, solids, meteorological as applicable) along with quality assurance procedures.
Chapter 6. Safe handling of hazardous waste and management procedures.
Chapter 7. Safety procedures followed
Chapter 8. Particulars of Practical Experiences in Industry / Organisation if any in Production/ Assembly/ Testing/Maintenance.
Chapter 9. Short report/description of the project (if any done during the training)
Chapter 10. Special/challenging experiences encountered during training if any (may include students liking & disliking of work places)

- References /Bibliography

10. SUGGESTED LEARNING STRATEGIES

Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc. They should also refer the handbooks of the major machines and operation, testing, quality control and standard operating procedures and practices used in the industry. Students may also visit websites related to other similar industries as their learning resource.

11. TENTATIVE WEEK-WISE SCHEDULE OF INDUSTRIAL TRAINING

The industrial training is a common course to all programmes, therefore the industry / Organization selection will depend upon the nature of programme and its related industry. The training activity may vary according to nature and size of Industry / Organization. The details of activities to be completed during 8 week wise Industrial Training schedule should be planned by the Industry. The evaluation of Industrial training will be done on the basis of skills acquired by the student during this 8 weeks period.

EVALUATION SHEET FOR PA OF INDUSTRIAL TRAINING

Sr. No.	Enrollment Number	Name of Student	Marks by Mentor & Industry Supervisor jointly	Marks by Industry Supervisor	Marks by Mentor Faculty	Total Marks
			Out of 40 (A)	Out of 30 (B)	Out of 30 (C)	Out of 100 (A+B+C)

DISTRIBUTION OF END-SEMESTER-EXAMINATION (ESE) MARKS OF INDUSTRIAL TRAINING

Marks for Industrial Training Report	Marks for Seminar/ Presentation	Marks for Oral/Viva-voce	Total ESE Marks
25	25	50	100