GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2023 (COGC-2023)
Semester-VI

Course Title: Environmental Audit and Legislation
(Course Code: **4361305**)

Diploma programme in which this course is offered	Semester in which offered
Environmental Engineering	Sixth

1. RATIONALE

The course in Environmental Monitoring provides an in-depth understanding of environmental monitoring techniques and methodologies. Students will learn to measure, analyze, and interpret environmental parameters crucial for assessing environmental quality. The course will cover air, water, soil, and noise monitoring, emphasizing practical applications and fieldwork.
This course provides an in-depth understanding of environmental audit principles, methodologies, and legislation relevant to environmental engineering. Environmental Audit and legislation is the mechanism to enforce environment friendly techniques/methods to business and industries. And hence knowledge of environmental Audit and legislation is an essential requirement for environment engineers. The diploma pass outs must have basic knowledge of environmental laws in India and various acts and rules related to environment and implementing authorities and their functions.

2. COMPETENCY

The course content should be taught and with the aim to develop required skills in students so that they are able to acquire following competencies.

- **Evaluate and assess environmental compliance, analyze potential environmental risks, and develop strategies for sustainable environmental management.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

a) Understand the principles and concepts of environmental audit.
b) Develop skills to conduct environmental audits in various settings.
c) Summarize environmental legislation and regulations applicable to environmental engineering.
d) Interpret various Environmental Acts, Rules and their Amendment

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA*	ESE	CA	ESE	
2	0	0	2	30	70	0	0	100

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** - End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES-Not Applicable

The following practical outcomes (PrOs) are the sub-components of the COs. *Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'*.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1			
			Total:

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii. *The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
	For PrOs 1 to 7	
1	Identification of Glassware and Equipment to perform various test	10
2	Prepare experimental setup accurately	10
3	Observe and record readings accurately	40
4	Calculate results accurately	20
5	Interpret results and their conclusions	10
6	Submission for progressive assessment on time	10
7	Viva Voce	10
	Total	**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED-Not Applicable

This major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1		

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs and PrOs. More could be added to fulfill the development of this competency.

a) Work as a team member/ individual.
b) Follow ethical practices.
c) Follow safe practice on site and in laboratory.
d) Practice of environmental friendly methods and processes.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher level UOs of *Revised Bloom's taxonomy* in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit – I **Introduction to Environmental Audit**	1a. Understand environmental audit and its Historical development and evolution. 1b. Identify various Types of environmental audits. 1c. Explain the Role of environmental auditing in sustainability and corporate social responsibility	1.1 Introduction to environmental audit: definitions, objectives, and importance 1.2 Historical development and evolution of environmental auditing 1.3 Types of environmental audits: compliance, management systems, performance-based audits 1.4 Role of environmental auditing in sustainability and corporate social responsibility
Unit – II **Principles and Methodologies of Environmental Audit**	2a. Describe Principles and guidelines for conducting environmental audits and steps involved in it. 2b. Explain methodology of – Pre audit activities , onsite activities , post audit activities 2c. Prepare audit criteria and checklists 2d. Conduct field	2.1 Principles and guidelines for conducting environmental audits 2.2 Steps involved in the environmental audit process 2.3 Methodology of – Pre audit activities , onsite activities , post audit activities 2.4 Audit criteria and checklists 2.5 Field assessments and data collection

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
	assessments and data collection	
Unit– III **Environmental Legislation and Regulatory Framework**	3a. Summarize environmental laws and regulations 3b. Analysis of key international, national, and local environmental legislations 3c. Explain Environmental permitting and compliance requirements 3d. Review Case studies on legal implications and consequences of non-compliance	3.1 Overview of environmental laws and regulations 3.2 Key international, national, and local environmental legislations 3.3 Environmental permitting and compliance requirements, CCA 3.4 Case studies on legal implications and consequences of non-compliance for e.g. sugar/pharma/Agro/Dyes unit, Zero liquid discharge etc.
Unit– IV **Important Environmental Acts, Rules and their Amendment**	4a. Interpret various Acts and rules pertaining to Environment Management	4.1 Sections and clauses of Water act, 1974 4.2 Sections and clauses of Air (Prevention and control) act, 1981. 4.3 Provisions of Hazardous waste rules, 1989 for management and handling of hazardous waste, Rule 9 and its importance. 4.4 Provisions of: Coastal regulation act, Biomedical Wastes (Management and Handling), Municipal Solid Waste Rules , Plastic Manufacturing Sale and Usage Rules 4.5 e-waste (Management) Rules, 2016, plastic waste management rules 2016

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A	Total Marks
I	Introduction to Environmental Audit	06	05	07	02	14
II	Principles and Methodologies of Environmental Audit	08	07	07	07	21
III	Environmental Legislation and Regulatory Framework	06	03	07	04	14

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A	Total Marks
IV	Important Environmental Acts, Rules and their Amendment	08	07	10	04	21
Total		**28**	22	**31**	**17**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Role play and case study on implementation of Environmental Protection laws , environmental Audit report
b) Solving environment protection related problems using different types of case studies having bearing of different acts.
c) Study CCA of various Industries
d) Undertake micro-project.
e) Give seminar on any relevant topic.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L' in section No. 4*** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Guide students on how to address issues on environment and sustainability

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed Six.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Select an industry or facility. Analyze and assess its compliance with relevant environmental legislation. Prepare a report highlighting areas of non-compliance.
b) Prepare flow chart of EIA process for any project, including scoping, baseline data collection, impact assessment, and mitigation measures.
c) Conduct a mock audit of waste management practices in a selected area or facility. Assess compliance with waste disposal regulations and propose sustainable waste management solutions.
d) Develop a plan for implementing ISO 14001:2015 in a hypothetical organization. Identify key elements and steps in the implementation process.
e) Choose a specific environmental law or regulation. Write a report discussing its history, impact, and current relevance.
f) Develop a campaign to raise awareness about environmental legislation in college. Create informative materials and conduct awareness session in college.
g) Study a legal case related to environmental issues. Analyze the court's decision, its implications, and the role of environmental laws in the case.
h) Choose a company and analyze its sustainability reports. Evaluate the company's environmental performance, compliance, and sustainability initiatives.
i) Study penalty imposed on any industry and prepare report citing the reasons for penalty and identify noncompliance to which environmental act.
j) Study closure imposed on any industry and prepare report citing the reasons for closure and identify noncompliance to which environmental act.
k) Select any ETP of nearby industry and determine adequacy and efficacy of ETP.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Handbook of Environmental Laws, Acts, Guidelines, Compliances & Standards	Trivedy R K	B.S. Publications (1 January 2010) ISBN-13 : 978−8178002217
2	Environmental Law And Policy In India	Divan Shyam, Rosencranz Armin	Oxford; Edition (1 February 2002),ISBN: 978-0195661736
3	Environment Management And Audit	P Mohana Rao, P Sasi Bhushana Rao	Deep & Deep Publications Pvt. Ltd. (1 January 2000) ISBN-13 : 978-8176292481

S. No.	Title of Book	Author	Publication with place, year and ISBN
4	Environment and climate change- Auditing Guidelines	-	CAG,India,2010

14. SOFTWARE/LEARNING WEBSITES

a) https://iced.cag.gov.in/

b) www.gpcb.gov.in

c) https://cpcb.nic.in/about-namp/www.neeri.res.in

d) www.Nptel.ac.in

15. PO-COMPETENCY-CO MAPPING

Semester II	Environmental Audit and Legislation (Course Code:4361300)									
	POs and PSOs									
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1 Environmental planning & deisgn	PSO 2 Environmental Impact Assessment	PSO 3 (If needed)
Competency	i. Evaluate and assess environmental compliance, analyze potential environmental risks, and develop strategies for sustainable environmental management.									
Course Outcomes										
a) Understand the principles and concepts of environmental audit.	3	3	-	-	3	2	2	3	3	-
b) Develop skills to conduct environmental audits in various settings.	3	3	3	2	3	2	2	3	3	-
c) Summarize environmental legislation and regulations applicable to environmental engineering.	3	3	3	-	3	2	2	3	3	-
d) Interpret various Environmental Acts, Rules and their Amendment	3	3	3	-	3	2	2	3	3	-

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation of each competency, CO, with PO/ PSO

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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