GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Environmental Impact Assessment
(Course Code: **4361303**)

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

1. RATIONALE

Environmental Impact Assessment course is a course for giving students opportunity to understand the purpose of Environmental Impact Assessment studies for making decision for better environmental management. This course provides an in-depth understanding of the principles, methods, and procedures involved in conducting Environmental Impact Assessments (EIAs).

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 the potential environmental impacts of proposed projects and formulate strategies for sustainable development.**

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 significance of EIAs in the context of environmental engineering.
b) Outline EIA process, guidelines, and regulations.
c) Identify environmental impacts by using EIA methods, tools and techniques.
d) Apply Remote sensing and GIS for EIA

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	
3	0	2	4	30	70	25	25	150

(*): 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

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	Conduct a site visit to a potential project site (e.g., construction site, industrial area). Students should identify and document potential environmental issues, stakeholders, and project features.	I,II	04
2	Simulate an impact assessment for a hypothetical project. Students can use case studies or create their own scenarios. They should identify potential impacts, predict their significance, and propose mitigation measures.	II,III	04
3	Conduct a role-playing exercise where students take on the roles of project developers, regulatory authorities, and community members. They should engage in a mock public consultation to understand different perspectives and challenges.	II,III	04
4	Given a hypothetical project with identified impacts, students should develop a comprehensive mitigation plan. This exercise can include cost considerations, feasibility, and long-term sustainability of proposed measures.	II,III	04
5	Provide students with actual EIA reports from completed projects. Students should review and critique the reports, assessing their completeness, effectiveness, and adherence to guidelines.	II,III	04
6	Students should design an environmental monitoring program for a specific project, considering the identified impacts. This exercise should include sampling methodologies, frequency, and parameters to be monitored.	II,III	04
7	Given a project scenario, students should identify and analyze the applicable environmental regulations and ensure that the proposed project complies with these regulations.	I,II,III	02
8	Study the application of Remote sensing data and GIS for overlaying various maps for decision making in the process of EIA	IV	02
			Total:28

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 potential environmental impacts.	10
2	Application of appropriate methodologies for impact prediction.	10
3	Integration of sustainability principles in mitigation strategies.	40
4	Application of best practices in EIA process	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

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	Not Applicable	

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 **Concepts of Environmental Impact Assessment**	1a. Summarize the Historical development and evolution of EIA in India 1b. Outline International and national laws, regulations, and guidelines for EIA 1c. Summarize Environmental legislations in India 1d. Interpret EIA Notification 2006	1.1 Historical development and evolution of EIA in India 1.2 International and national laws, regulations, and guidelines for EIA 1.3 Environmental legislations in India 1.4 EIA Notification 2006
Unit – II **Environmental clearance process in India**	2a. Describe various activities involved in EIA process 2b. Interpret various category of projects and types of EIA 2c. Differentiate between EIA and SEA 2d. Compare EIA procedures followed in India and other countries	2.1 Screening, scoping, Impact analysis, Mitigation, Reporting, Review, Decision making, Post monitoring 2.2 Category of projects 2.3 Generic structure of EIA report 2.4 Terms of Reference (ToR) 2.5 Types of EIA: strategic, regional, sectoral, project level- Rapid EIA and Comprehensive EIA- Initial Environmental Examination (IEE), SEA(Strategic Environment Assessment) 2.6 Difference between EIA and SEA 2.7 Comparative review of EIA procedures and practices in Developed countries, Developing countries and India
Unit– III **EIA Methods, Tools and Techniques**	3a. Summarize various EIA methods tools and techniques 3b. Describe Procedure For EIA Clearance 3c. Determine the Importance of Environmental Management Plan	3.1 Ad-hoc method, maps and overlays, check lists, matrix, cause condition impacts. Environmental Base map, Environmental Impact statements 3.2 Impact Prediction, Evaluation and Mitigation-Prediction and assessment of the impact on water (surface water and groundwater), air, and noise environment- assessment of ecological impacts and Socio economic Impacts. 3.3 Procedure For EIA Clearance: EIA review and screening; state level screening, clearance from DOE and MOEF.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
		3.4 Environmental Management Plan (EMP): Goal and purpose- Importance of EMP- Content of an EMP
Unit– IV **Application of Remote sensing and GIS for EIA**	4a. Understand the Concept of Environmental remote sensing 4b. Identify Application of RS in EIA 4c. Understand GIS concepts and techniques	4.1 Concept of Environmental remote sensing 4.2 Basic principles of remote sensing 4.3 Application of RS in EIA of Linear projects/coastal zone studies/ Landuse Landcover studies 4.4 GIS concepts and techniques 4.5 GIS in screening, scoping and baseline studies, Impact prediction and mitigation

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	Concepts of Environmental Impact Assessment	04	02	03	02	07
II	Environmental clearance process in India	12	07	07	07	21
III	EIA Methods, Tools and Techniques	16	07	14	07	28
IV	Application of Remote sensing and GIS for EIA	10	04	07	03	14
Total		**42**	**20**	**31**	**19**	**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 plays activity, showing concern for environment as a result of some project and role of public.
b) Assignments based on concept of EIA
c) Assignments based on Detailed Contents of EIA

d) Assignments based on Environmental Attributes.
e) Undertake micro-project.
f) 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) Develop screening criteria for a specific type of project (e.g., small-scale industrial project, infrastructure development). Consider environmental and social factors that should trigger a full EIA.
b) Conduct a scoping exercise for a proposed urban development project. Identify key environmental and social issues and stakeholders in the vicinity.
c) Propose mitigation measures for a hypothetical wastewater treatment plant. Consider issues related to water quality, odor, and ecosystem impacts.
d) Develop a public consultation plan for a renewable energy project. Identify stakeholders, communication methods, and strategies for addressing concerns.
e) Review an existing EIA report for a selected project (e.g., wind farm, industrial facility). Evaluate the completeness and effectiveness of the report.

f) Design an environmental monitoring program for a hypothetical mining project. Consider parameters such as water quality, soil stability, and biodiversity.
g) Analyze the regulatory requirements for a coastal development project. Ensure compliance with environmental regulations related to coastal zones.
h) Assess the potential impacts of a forest conservation project on biodiversity. Identify measures to protect and enhance local ecosystems.
i) Integrate sustainability principles into an EIA for a solar farm. Consider not only environmental impacts but also social and economic aspects.
j) Predict potential environmental impacts of a road construction project. Focus on issues like soil erosion, habitat disruption, and air quality.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Environmental Impact Assessment	Larry Canter	McGraw-Hill science/Engineering/Math; 2nd edition (September 1, 1995); ISBN-13 : 978-0070097674
2	Environmental Impact Assessment: Theory and Practice	Anji Reddy Mareddy	Butterworth-Heinemann; 1st edition (June 14,2017) ISBN: 978-9352301386
3	Environmental Impact Assessment Methodologies	Anjaneyulu Yerramilli , Valli Manickam	BS Publications / BSP Books; 3rd edition (1 January 2020) ISBN-13 : 978-9388305822

14. SOFTWARE/LEARNING WEBSITES

a) ERDAS Imagine
b) Arc GIS
c) QGIS
d) www.gpcb.gov.in
e) https://cpcb.nic.in/about-namp/www.neeri.res.in
f) www.Nptel.ac.in
g) https://environmentclearance.nic.in/

15. PO-COMPETENCY-CO MAPPING

Semester II	Environmental Impact Assessment (Course Code:436130**0**)									
	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 the potential environmental impacts of proposed projects and formulate strategies for sustainable development.									
Course Outcomes a) Understand the significance of EIAs in the context of environmental engineering	3	-	-	-	3	-	2	3	3	-
b) Outline EIA process, guidelines, and regulations.	3	-	-	-	3	-	2	3	3	-
c) Identify environmental impacts by using EIA methods, tools and techniques	3	3	3	2	3	-	2	3	3	-
d) Apply Remote sensing and GIS for EIA	3	3	3	3	3	-	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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