<u>**Lesson and Evaluation Plan - EN 529**</u>
<u>**Spring 2024 Semester**</u>

**School:** **Engineering**
**Department:** **Energy**
**Course Code:** **EN 529**
**Course Name:** **Energy, Climate Change and Carbon Trade**
**Instructor:** **Dr N Sarmah**

**1. Abstract**:

 The role of energy is increasingly important with growing environmental constraints, international pressure on climate change compliance and increasing trend in energy consumption. This course deals with science of climate change, factors causes' climate to change across different time scales and possible consequences of climate change. Carbon trading is a market mechanism designed to put a price on carbon to reduce carbon dioxide emissions and helps to reduce the emission. Carbon trading forms a part of the wider sustainability issue, and it is helpful for students to understand the concept and implications of carbon trading.

**2. Objective:**

The course is designed with objectives to prepare students to deal with climate change mitigation approaches. The causes of climate change and solution for different scenarios will be discussed. At the end of the course the student is capable to:

> CO1: Understand the climate change and its local and global dimension

> CO2: Assess the different mechanisms of carbon trading for mitigation of climate change

> CO3: Analyze the international initiatives to curb climate change

Furthermore, the objective of the different units of the course has been given in the table below. At the end of the following units the student is capable of:

| Unit | Topic | Learning Objectives |
|---|---|---|
| Unit 1: | Energy and Climate Change | To understand relation of energy use and its effect on climate change. |
| Unit 2: | Climate Change mitigation approaches | Different mitigation approaches adopted by various agencies |
| Unit3: | Carbon Credit | To understand the carbon market and limitations of carbon trade |

**3. Prerequisites of the course**:

 This course is a core course for the students of M.Tech. in Energy Technology programme.

**4. (a)Time-Plan**

| Tentative Lectures | Topic to be covered | No. of classes |
|---|---|---|
| 1-15 | **Energy and Climate Change** <br> Global Consensus, GHGs emission and energy activities; Montreal protocol, evidence and predictions and impacts, Clean energy technologies, Energy economy, Risk and opportunities; Measures to reduce GHGs; Role of renewable energy, Evidence of economic impacts of climate change and economics of stabilizing greenhouse gases. <br> Carbon dioxide ($CO_2$) emissions due to energy conversion; combustion physics; case studies and comparison of (i) different technologies and (ii) different resources used for energy conversion; Role of technology up-gradation and alternative resources on reduction of $CO_2$ emission; | 15 |
| 16-27 | **Climate Change mitigation approaches** <br> Climate Change Act, Kyoto Protocol and CDM, Government's policies for mitigation and adaptation, National Action Plan on Climate change, Nationally Appropriate Mitigation Actions (NAMA), Intended Nationally Determined Contributions (INDCs). New Industrial Emissions Directive, Categorization of Scope 3 Emissions for Streamlined Enterprise, Carbon Foot printing, Calculating Scope 3 Emissions, Methodology for $CO_2$ assessment; UNFCCC baseline methodologies for different conversion process, estimation of emission from fossil fuel combustion; Case studies | 12 |
| 28-36 | **Carbon Credit** <br> Carbon credit: concept and examples; Commerce of Carbon Market, Environmental transformation fund; Technology perspective: Strategies for technology innovation and transformation; future prospect/limitation of carbon trading mechanism | 9 |
| **Total** | | **36** |

(b) **Evaluation plan**

| Tests | Tests | *Date | Marks | Time |
|---|---|---|---|---|
| Test 1 | Descriptive/ Objective/ Quiz | As per the academic calendar and notification | 25 | 45 min |
| Test 2 | Descriptive/ Objective/ Quiz | As per the academic calendar and notification | 40 | 2 hours |
| Test 3 | Assignment/Seminar/Case study) | As per the academic calendar and notification | 25 | --- |
| Test 4 | Descriptive/ Objective | As per the academic calendar and notification | 60 | 3 hours |
| | **Total** | | **150** | |

* As per the Tezpur University examination schedule

**5. Pedagogy:**

The primary teaching/learning methods of the course will be classroom teaching and learning. The classroom teaching will include lectures; interactive sessions on the topics of the course; seminars on the chosen topics

etc. It is expected that this kind of teaching-learning activities will help in developing analytical thinking of the students. In summary teaching learning method to be adopted for the course are:

- Lecture/Discussion using LCD projector and white board
- Flipped classroom
- Interactive sessions
- Seminar by the student
- Quiz

## 6. Text Books

[1] Mathez E. A. (2009); Climate Change: The Science of Global Warming and Our Energy Future, First edition, Columbia University Press

[2] Dessler A. (2011); Introduction to Modern Climate Change, Cambridge University Press

## 7. References

[1] Stern N. (2007); The Economics of Climate Change. The Stern Review. Cambridge University Press

[2] IPCC (Intergovernmental for Climate Change), (2007). Climate Change (2007): Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press

[3] Yamin F. (ed) (2005); Climate Change and Carbon Markets: A Handbook of Emissions Reduction Mechanisms, Earthscan

[4] Clean Development Mechanism, UNFCC Website; http://cdm.unfccc.int/

[5] Franchetti M. J. and Apul D. S. (2013); Carbon Footprint Analysis: concepts, methods, implementation and case studies, CRC Press

## CO – PO Mapping and Assessment Criteria
## EN529 Energy, Climate Change and Carbon Trade

| | |
|---|---|
| CO1 | Understand the climate change and its local and global dimension |
| CO2 | Assess the different mechanisms of carbon trading for mitigation of climate change |
| CO3 | Analyze the international initiatives to curb climate change |

| Course Outcomes, Mapping and Weightage with Programme Outcomes [Weightage (%)] | | | |
|---|---|---|---|
| **PO1** | CO1 | | |
| **PO2** | | CO2 | |
| **PO3** | | | CO3 |
| **PO4** | | | |

| Course Outcomes, Mapping and Weightage with Programme Outcomes [Weightage (%)] | | | | | | |
|---|---|---|---|---|---|---|
| **Course Outcomes** | **Weightage of Marks** | **Test-I** | **Test-II** | **Test-III** | **Test-IV** | **Total** |
| **CO1** | 24% | 20 | 10 | | 5 | 35 |
| **CO2** | 44% | 5 | 30 | | 30 | 65 |
| **CO3** | 32% | | | 25 | 25 | 50 |
| **CO4** | | | | | | |
| **Total** | **100%** | **25** | **40** | **25** | **60** | **150** |

| Assessment Criteria | | | | | | |
|---|---|---|---|---|---|---|
| **Bloom Taxonomy** | **Level** | **Marks Weightage (%)** | **Assessment - I** | **Assessment - II** | **Assessment - III** | **Assessment - IV** |
| Knowledge | Easy | 10% | 5 | 10 | 0 | 0 |
| Understanding | Average | 16% | 10 | 10 | 0 | 5 |
| Application | Average | 17% | 0 | 15 | 0 | 10 |
| Analysis | Difficult | 43% | 10 | 0 | 25 | 30 |
| Evaluation | Difficult | 7% | 0 | 5 | 0 | 5 |
| Application | Difficult | 7% | 0 | 0 | 0 | 10 |
| Total | | **100%** | **25** | **40** | **25** | **60** |