

CET468	CLIMATE CHANGE AND SUSTAINABILITY	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PEC	3	0	0	3	2019

**Preamble:** Goal of this course is to expose the students to the fundamental concepts of climate, its influencing factors, climate change and its relationship with sustainability. After this course, students will be able to recognize the real-world problems that can happen due to climate change, aware of the various mitigation and adaptation techniques using sustainable technologies for combating the adverse impacts due to climate change and respond accordingly.

**Prerequisite:** Nil

**Course Outcomes:** After completion of the course the student will be able to:

CO 1	Explain the fundamental concepts of climate and its influencing factors
CO 2	Explain the factors affecting climate change and the harmful impacts due to climate change
CO 3	Discuss the problems due to urbanization and the need for sustainable development
CO 4	Demonstrate the various adaptation and mitigation techniques for combating climate change
CO 5	Discuss multilateral agreements on climate change, Case studies on Climate change

**Mapping of course outcomes with program outcomes (Minimum requirement)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	2	-	2	-	-	2	-	-	-	-	-
CO 3	-	3	-	3	-	-	2	-	-	-	-	-
CO 4	2	-	-	-	-	-	3	-	-	-	-	-
CO 5	-	-	-	-	-	-	2	-	-	-	-	-

**Assessment Pattern**

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	20	20	40
Understand	20	20	40
Apply	10	10	20
Analyze			
Evaluate			
Create			

**Mark Distribution**

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

**Continuous Internal Evaluation (CIE)Pattern :**

Attendance	: 10 Marks
Continuous Assessment Test (2 numbers)	: 25 Marks
Assignment/Quiz/Course project	: 15 Marks

**End Semester Examination (ESE)Pattern :** There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

**Course Level Assessment Questions**

*(Questions may be framed based on the outline given under each course outcome)*

**CO1: Explain the fundamental concepts of climate and its influencing factors**

1. What is atmospheric stability?
2. Explain in detail the factors influencing climate.
3. Discuss how inversions are formed.

**CO2: Explain the factors affecting climate change and the harmful impacts due to climate change**

1. Explain vulnerability index.
2. Discuss the impact of climate change on agriculture.
3. What are the anthropogenic drivers of climate change?

**CO3: Discuss the problems due to urbanization and the need for sustainable development**

1. Explain urban heat islands.
2. What are the causes for urban floods?
3. Discuss how life cycle analysis helps in sustainable development.

**CO4: Demonstrate the various adaptation and mitigation techniques for combating climate change**

1. How green engineering can help in combating climate change?
2. Explain circular economy
3. Discuss nature based solutions in disaster management.

**CO5: Discuss multilateral agreements on climate change, Case studies on Climate change**

1. What is Clean Development Mechanism?
2. How emission trading helps fighting climate change?
3. Explain Kyoto mechanisms to reduce GHG emissions.

**Syllabus****Module 1****Climate**

Climate and weather, Meteorology and climatology, Composition and structure of atmosphere. Factors influencing climate-Insolation, Temperature, Humidity, Pressure, Wind, Precipitation, Topography. Atmospheric stability, Lapse rate, Inversions, Types of inversions. Cyclones and Anticyclones.

**Module 2****Climate change**

Climate change, anthropogenic drivers of climate change, Global warming, Green house effect, Air pollution, carbon foot print, Impact of climate change on water cycle, agriculture, forest, water resources, urban areas, biodiversity, human health. Carbon sequestration, vulnerability index.

**Module 3****Urbanisation and Sustainable development**

Urbanisation and Industrialization, Urbanisation, problems of urbanisation, Urban sprawl, Urban heat islands, causes, mitigation measures. Urban flooding, water conservation and ecological aspects. Urban Planning, Zoning of Land Use

Pillars of Sustainable development, Sustainability indicators, Life cycle analysis, Material flow analysis, Green energy, Waste management, 3R concepts, Sustainable cities, Sustainable Urbanisation

**Module 4****Adaptation and mitigation strategies**

Green Engineering, Design for Engineering, Green technologies, Circular economy. Planning of cities as climate resilient, Climate change and infrastructure planning, Climate resilient infrastructure, nature based solutions in disaster management, adaptation strategies for combating climate change

**Module 5****Climate and sustainability**

Sustainability Engineering , Kyoto mechanisms to reduce GHG emission- Clean Development Mechanism, Joint Implementation, Emission trading, Case studies on Kyoto mechanism, Case studies on climate change and climate change risk reduction.

**Text/Reference Books**

- Lal, DS, “Climatology”, Published by Sharda Pustak Bhawan, ISBN8186204121
- John T. Hardy, Jean Ponce, “Climate Change - Causes, Effects, and Solutions”, Wiley Publications, 2003
- Jonathan Tomkin, Tom Theis, "Sustainability - A Comprehensive Foundation", 12th Media Services, 2018
- Karthik Karuppu, "Green Building Guidance: The Ultimate Guide for IGBC Accredited Professional Examination Book", NVICO Notion Press, 2019
- Keith D. Alverson, ZintaZommers, "Resilience : The science of adaptation to climate change", Elsevier, 2018
- Leal Filho, W., Azul, A.M., Brandli, L., Özuyar, P.G., Wall, T. (Eds.), “Sustainable Cities and Communities” Springer
- Intergovernmental Panel on Climate Change (IPCC) reports

## Course contents and Lecture schedule

Module	Topic	Course Outcomes addressed	No. of Lectures
<b>1</b>	<b>Module 1: Total Lecture Hours -7</b>		
1.1	Climate and weather, Meteorology and climatology, Composition and structure of atmosphere.	CO1	1
1.2	Factors influencing climate-Insolation, Temperature, Humidity, Pressure, Wind, Precipitation, Topography.	CO1	2
1.3	Atmospheric stability, Lapse rate, Inversions, Types of inversions.	CO1	3
1.4	Cyclones and Anticyclones.	CO1	1
<b>2</b>	<b>Module II: Total Lecture Hours- 7</b>		
2.1	Climate change, anthropogenic drivers of climate change	CO2	1
2.2	Global warming, Green house effect, Air pollution, carbon foot print,	CO2	2
2.3	Impact of climate change on water cycle, agriculture, forest, water resources, urban areas, biodiversity, human health.	CO2	3
2.4	Carbon sequestration , vulnerability index.	CO2	2
<b>3</b>	<b>Module III: Total Lecture Hours-7</b>		
3.1	Urbanisation and Industrialization, Urbanisation, problems of urbanisation, Urban sprawl, Urban heat islands, causes, mitigation measures.	CO3	2
3.2	Urban flooding, water conservation and ecological aspects. Urban Planning, Zoning of Land Use	CO3	1
3.3	Pillars of Sustainable development, Sustainability indicators,	CO3	1
3.4	Life cycle analysis, Material flow analysis,	CO3	1
3.5	Green energy, Waste management, 3R concepts,	CO3	1
3.6	Sustainable cities, Sustainable Urbanisation	CO3	1
<b>4</b>	<b>Module IV: Total Lecture Hours- 7</b>		

4.1	Green Engineering, Design for Engineering, Green technologies	CO4	2
4.2	Circular economy	CO4	1
4.3	Planning of cities as climate resilient, Climate change and infrastructure planning, Climate resilient infrastructure.	CO4	2
4.4	Nature based solutions in disaster management	CO4	1
4.5	Adaptation strategies for combating climate change	CO4	1
<b>5</b>	<b>Module V: Total Lecture Hours- 7</b>		
5.1	Sustainability Engineering , Kyoto mechanisms to reduce GHG emission, Case studies on Kyoto mechanism.	CO4	3
5.2	Clean Development Mechanism, Joint Implementation, Emission trading	CO3, CO4	2
5.3	Case studies on climate change and climate change risk reduction	CO4	2

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**Model Question Paper**

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY  
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION**

**Course Code: CET 468**

**Course Name: CLIMATE CHANGE & SUSTAINABILITY**

Max. Marks: 100

Duration: 3 Hours

**Part A**

*(Answer all questions; each question carries 3 marks)*

1. Explain lapse rate.
2. How climate is different from weather.
3. What is carbon footprint?
4. Explain carbon sequestration.
5. Explain urban sprawl.
6. What is 3R concept in waste management?
7. What is a climate resilient city?
8. How adaptation and mitigation strategies are different?.
9. Explain CDM.
10. What is emission trading?

**PART B**

*(Answer one full question from each module, each question carries 14 marks)*

11. (a) Discuss how inversions are formed. What are different types of inversion? (7 Marks)  
(b) Describe the composition and structure of atmosphere with a neat sketch .(7 Marks)
- OR
12. (a) Explain in detail the factors influencing climate (8 Marks)  
(b) Compare cyclones and anticyclones ? (6 Marks)
13. (a) Discuss the impact of climate change on agriculture (8 Marks)

(d) Explain vulnerability index (6 Marks)

OR

14. (a) What are the anthropogenic drivers for climate change? (8 Marks)

(b) Explain Green house effect. How it influence climate? (6 Marks)

15. (a) What is urban heat island? What are the causes? (8 Marks)

(b) Explain life cycle analysis. (6 Marks)

OR

16. (a) Discuss the causes and mitigation measures for urban flood (7 Marks)

(b) Explain the pillars of sustainable development (7 Marks)

17. (a) Explain how green technologies help in combating climate change. (7Marks)

(b) Discuss nature based solutions in disaster management. (7 marks)

OR

18. (a) Explain how circular economy concepts helps in climate change mitigation (7 Marks)

(b) What are the factors to consider while designing a climate resilient city? (7 Marks)

19. (a) Explain Kyoto mechanisms to reduce GHG emissions (7 Marks)

(b) How emission trading is effective as a climate change reduction strategy? (7 Marks)

OR

20. Elaborate climate change reduction strategies with an example case study (14 Marks)

