DEPARTMENT OF

CHEMICAL ENGINEERING

Model Questions - Global Climate Change (22EM204)

(Units 2, 3 &4)

Unit-1

1. How climate is different from weather? Which are the components that influence the climate system?
2. What are the various processes that influence the climate.
3. What is Climate Change? Discuss about the Atmospheric climate variables that affect climate system.
4. Is our climate changing? What is the evidence that shows the climate is changing?
5. Why climate change a serious problem?
6. Explain Wien's displacement law and Stefan–Boltzmann equation.
7. What are greenhouse gases?
8. Explain how green house gases cause global warming?
9. List out the human activities that cause climate change
10. Who are responsible (countries) for the global climate change.
11. Define black body radiation
12. Write a short note on electromagnetic spectrum.

Unit-2

1. Explain transfers of carbon between rock and atmosphere.

2 How are humans perturbing the carbon cycle?

3 Assume a planet with a one-layer atmosphere has a solar constant of S = 1,000 W/m2 and an albedo of α = 0.4.

a) Derive the expression for planet's surface temperature and calculate the same. Make the standard assumption that the atmosphere is transparent to visible photons but opaque to infrared photons.

4 Explain how "chemical weathering" removes CO2 from the atmosphere. What is the weathering chemical reaction? Can this process play an important role in counteracting the increase in atmospheric carbon dioxide caused by humans?

5 Assume a planet with a two-layer atmosphere has a solar constant of S = 2,000 W/m2 and an albedo of α = 0.4.

a) Derive the expression for planet's surface temperature and calculate the same. Make the standard assumption that the atmosphere is transparent to visible photons but opaque to infrared photons.

6 Discuss on emission of methane into the atmosphere from various sources and atmospheric abundances of methane.

7 Describe the composition of our atmosphere, with a particular focus on greenhouse gases.

8 Explain the exchange of carbon exchange between the atmosphere, land biosphere, and ocean with the help of schematic diagram.

Unit-3

1. Explain the factors that control emissions.
2. Explain how factors that control emissions have changed in the recent past.
3. Explain how factors that control emissions will change over the 21st century.
4. Discuss about the summary of emissions scenarios constructed by IPCC.
5. Write a short note on predictions of future atmospheric composition based on emissions scenarios created by IPCC.
6. What are the names of the four main emissions scenarios discussed created by IPCC
7. In just a few sentences, explain the main differences between them.
8. Explain how your level of wealth impacts how much emission of carbon dioxide you are responsible for.
9. Summarize predictions on climate change beyond 2100.
10. How temperature, precipitation, sea level, extreme events, and other such phenomena will change in future
11. How the impact of climate changes impact on humans and those aspects of the environment that we rely on.
12. Why abrupt climate changes are a serious problem?

Unit-IV

1. What is mitigation of climate change?
2. What is adaptation to climate change?
3. What are the two main reasons for the increase in historical carbon emissions?
4. List five things that can be done to mitigate climate change.
5. What is the goal of the United Nations Framework Convention on Climate Change as expressed in its
6. What personal actions would you consider to take in order to mitigate climate change impacts?
7. Why will we need to adapt to future climate change impacts?
8. Think about a particular region/country of the world that may be affected by climate change. What measures could be taken to adapt to the changes?
9. a) Explain how a carbon tax works.
   b) Explain how a cap-and-trade system works.
   c) What is the fundamental difference between these two policies?
   d) Given a carbon tax of x dollars (or a permit price of $\$x$), an emitter will reduce emissions until what criterion is satisfied?

10 Why are emissions reductions achieved by use of a carbon tax or cap-and-trade system cheaper than those achieved by use of conventional regulations?

11. a) What is an offset?

b) What does *additionality* mean?

12. The table below shows the marginal costs of the following two plants, each of which emits 10 units each year. They both have six permits, meaning that each would have to reduce 4 units.

Number of units reduced	Marginal costs for Plant A	Marginal costs for Plant B
1	1	3
2	2	6
3	3	9
4	4	12
5	5	15
6	6	18
7	7	21

a) How many permits will Plant B buy from Plant A?
b) In what price range will these permits exchange hands?
13. Why won't voluntary and informational approaches lead to deep reductions in emissions?