



MASEÑO UNIVERSITY
UNIVERSITY EXAMINATIONS 2015/2016

**FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR THE
DEGREE OF MASTER OF SCIENCE IN ENVIRONMENTAL
SCIENCE**

(CITY CAMPUS)

NES 822: EARTH SYSTEMS SCIENCE

Date: 8th December, 2015

Time: 9.00 - 12.00 noon

INSTRUCTIONS:

- Answer ANY FOUR questions.

NES 822: EARTH SYSTEMS SCIENCE

Date:

Time: 3hrs

INSTRUCTIONS:

Answer any **FOUR** Questions

1. Prove that moving a parcel of dry air up or down will cause its temperature to change by $9.76^{\circ}\text{C}/\text{km}$, or essentially $1^{\circ}\text{C}/100\text{m}$. **(15mks)**
2. Construct a general model of the atmosphere based on the criteria composition, temperature, and function and diagram this model in a simple sketch. **(15mks)**
3. a) The concentration of CO_2 in 1965 was 320ppm; while in 1990 it was 355ppm. If we model that growth with a simple exponential function, what growth rate would that correspond to? At what exponential rate of growth, in what year would atmospheric concentrations be twice the 280ppm preindustrialization value? **(6mks)**

b) Describe carbon cycle.

(9mks)

4. Describe what happens to insolation when clouds are in the atmosphere and analyze the effect of clouds and air pollution on solar radiation received at ground level. (15mks)
5. Using data from the following table for approximate preindustrial concentrations and 1985 concentrations, estimate the combined equilibrium temperature change for 1985. Using the assumed growth rates, estimate the equilibrium temperature increase (compared to preindustrial times) in the year 2075. Assume ΔT_d is 3°C . (15mks)

Gas	1850	1985	Assumed Growth rate 1985 -2075
CO ₂	280 ppm	345 ppm	0.57%
CH ₄	1150 ppb	1790 ppb	1%
N ₂ O	285 ppb	305 ppb	0.5%
CFC-11	0 ppb	0.24 ppb	2.5%
CFC-12	0 ppb	0.40 ppb	2.5%

6. Describe systems analysis, open and closed systems, feedback information, and system operations and relate these concepts to Earth systems. (15mks)