MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

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

CITY CAMPUS

NES 822: EARTH SYSTEMS SCIENCE

Date: 2nd December, 2016

Time: 2.00 - 5.00 pm

INSTRUCTIONS:

- Answer ANY FOUR questions.

1. Describe the A, C, D and E climate classification categories and locate these regions on a world map. **(20 marks)**

2. Illustrate the geological cycle and relate the rock cycles and rock types to endogenic and exogenic processes. **(20 marks)**

3. Discuss earth systems Science as a concept that every environmental scientists must be grounded in. **(20 marks)**

4. Prove that the Global average temperature is 255K and not 288 K and account for the difference. **(20 marks)**

5. a) The concentration of CO_2 in 1965 was 320 ppm, while in 1990 it was 355 ppm. If we model that growth with a simple exponential function, what growth rate would that correspond to? At that exponential rate of growth, in what year would atmospheric concentrations be twice the 280 ppm preindustrialization value? **(6 marks)**

   b) Assume the following statistics for CFC -12 (CF_2Cl_2):

Atmospheric residence time	= 150 yr
1985 emission rate	= 0.44 x 10^{12} g/yr
1985 atmospheric concentration	= 0.40 ppb

   Suppose the emission rate of CFC-12 is instantaneously reduced to 50 percent of its 1985 value and held constant thereafter:

   i) What would be the final, steady-state atmospheric concentration of CDF-12? **(7marks)**

   ii) What cut in the emission rate would be required for CFC-12 concentrations to remain constant at the 1985 level of 0.40 ppb? **(7 marks)**

6. Using data from the following table for approximate preindustrial concentrations and 1985 concentration,

Gas	1850	1985	Assumed growth rate 1985-2075
CO_2	280 ppm	345 ppm	0.57%
CH_4	1150 ppb	1790 ppb	1%
N_2O	285 ppb	305 ppb	0.5%
CFC-11	0 ppb	0.24 ppb	2.5%
CFC-12	0 ppb	0.40 ppb	2.5%

i)   Calculate the combined equilibrium temperature change for 1985.

(8 marks)

ii) Using the assumed growth rates, calculate the equilibrium temperature increase (compared to preindustrial times) in the year 2075.
Assume ΔT_d is 3°C.

(12 marks)