RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Third Year - Semester II Examination – October/November 2014

PHY 3302 –METEOROLOGY

Answer **all (06)** questions   Time allowed: **3 hours**

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1. (a) List the four thermal layers of the earth's atmosphere and describe their characteristics.   [8]

   (b) What is outgassing and why is it important to the earth's atmosphere?   [3]

   (c) "The greenhouse effect is responsible for keeping the Earth a habitable place. However, this phenomenon has been enhanced by human activity making the Earth sub-optimal for many species". Briefly discuss this statement.   [6]

   (d) What is the *solar constant*? The solar constant is about 1367 W/m^2 at the edge of the earth's atmosphere. If the distance between Earth and Sun were to double, what would be the new value?   [3]

2. (a) What is electromagnetic radiation?   [2]

   (b) What happens to incoming solar radiation as it moves through the atmosphere?   [4]

   (c) How is latent heat an important source of atmospheric energy?   [3]

   (d) If the earth's surface continually radiates energy, why does not it become progressively colder?   [3]

(e) Explain why Southern Hemisphere summers are not as warm as Northern Hemisphere summers. [3]

(f) Compare and contrast Rayleigh and Mie scattering [5]

3. (a) Explain the concepts of equilibrium and saturation with respect to the vapor pressure. [3]

(b) What weather conditions are best suited for the formation of a cold night and a strong radiation inversion? [3]

(c) Is humid air heavier than dry air? Explain. [3]

(d) What are condensation nuclei? Are they typically made of the same materials? [3]

(e) How does droplet size affect rates of evaporation and condensation? [3]

(f) Distinguish among dry haze, wet haze, and fog. [5]

4. (a) What is an adiabatic process? [2]

(b) Explain the difference between environmental lapse rate and dry adiabatic lapse rate. [3]

(c) Briefly explain what happens as a parcel of unsaturated dry air rises? [3]

(d) Describe several ways in which an eddy (a whirl of air) might form in the atmosphere. [4]

(e) Comment on the conditions necessary for the development of ordinary thunderstorms? [3]

(f) Describe two methods used for weather forecasting. [5]

5. (a) What is a stable atmosphere and how is it formed? [3]

(b) Describe the general characteristics of clouds associated with stable and unstable atmospheres. [5]

(c) Compare cloud droplets and raindrops and comment on why typical cloud droplets seldom reach the ground as rain. [6]

(d) Comment on whether the collision-and-coalescence process work better at producing rain in, a warm, thick nimbostratus cloud or in a, towering cumulus congestus cloud? [3]

(e) What is Bergeron process? Why cannot the Bergeron process take place in warm clouds? [3]

6. (a) Why does air pressure decrease with height more rapidly in cold air than in warm air? [2]

(b) Explain how the pressure gradient force, the Coriolis force, and frictional force determine the movement of air in the free atmosphere and in the planetary boundary layer. [6]

(c) What are geostrophic and gradient flows? Why do not they occur near the surface? [3]

(d) Since there is always an upward-directed pressure gradient force, why does not the air rush off into outer space? [4]

(e) Suppose the atmospheric pressure at the bottom of a deep air column 5.6 km thick is 1000 mb. If the average air density of the column is 0.91 kg/m^3, and the acceleration of gravity is 9.8 m/sec^2, use the hydrostatic equation to determine the atmospheric pressure at the top of the column.
(Hint: Be sure to convert km to m and mb to Newtons/m^2, where 1 mb =100 N/m^2) [5]