16

RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree

Third Year - Semester II Examination - September/October 2013

PHY 3302 – Applied Meteorology

Answer 6 questions only **Duration: 3 hours**

---

1. (a) How does weather differ from climate? What are the main factors that determine seasonal temperature variations?

   (b) What are the four mechanisms which cause air to rise and form moist clouds?

   (c) Air temperature is a critical meteorological variable. Why? Give two reasons?

2. (a) Derive the hydrostatic equation for the atmosphere in hydrostatic balance.

   (b) Define Geopotential and write down the equation for the geopotential thickness of an air layer between two pressure levels.

   (c) A hurricane with a central pressure of 940 hPa is surrounded by a region with a pressure of 1010 hPa. The storm is located over an ocean region. At 200 hPa, the depression in the pressure field vanishes (i.e. the 200 hPa surface is perfectly flat as shown in the figure 1).

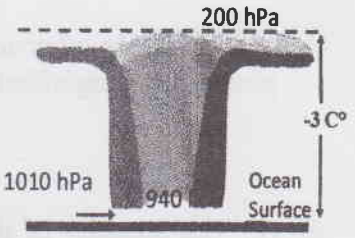

Fig. 1

Estimate the average temperature difference between the centre of the hurricane and its surrounding. Assume that the mean temperature of this layer outside the hurricane is -3 C° and ignore the vertical temperature correction. (Given $R_d/g_o = 29.3$)

Ctd...

3. (a) What is it meant by "*front*" used in meteorology and name three "*fronts*" which can be seen in weather maps.

   (b) What is "*dew point*"? Why "*dew point*" is a better measurement of human discomfort than the relative humidity?

   (c) Estimate the pressure difference between the top and the bottom of a building of 50 m high, when the pressure at the bottom is 100 hPa and the temperature is 25 C°.

4. (a) What are the four forces that influence the wind? Which one of these is responsible for generating the wind?

   (b) What is it meant by reduction of pressure to sea level? Explain why it is necessary to reduce station pressure to sea level?

   (c) A barometer placed at a meteorological station with outside temperature of -12C°, records surface pressure as 900 hPa. The sea level pressure at that location is found to be 1010 hPa. What is the height of the station? (Given $R_d/g_o = 29.3$)

5. (a) What is a thunderstorm and name three stages of forming it? Give three weather conditions which can be observed immediately before a thunderstorm.

   (b) What is a tornado? To develop a tornado, several conditions must be present in the atmosphere at the same time. List them and explain briefly how a tornado forms.

   (c) How does a hurricane form? List major parts of a hurricane. Briefly explain how global warming affects the formation of stronger hurricanes?

6. (a) The stability of the atmosphere is identified by two quantities. Name them and explain why we need to know both of them.

   (b) Describe *"La Niña"* phenomenon and weather changes associated with it in the Pacific and Eastern Indian Oceans. What courses a *"La Niña"* event and discuss its effect on the global weather changes briefly.

   (c) What type of changes will take place in the physical environment if the stratospheric ozone layer is depleted?

Ctd...

7. (a) State Stefan-Boltzmann Law giving a mathematical expression.

   (b) Define the inverse square law in radiation and explain why this concept is important.

   (c) The planet, Ω is at a distance of $d_\Omega = 8 \times 10^7$ km from the Sun with albedo $A_\Omega = 0.8$. The solar constant at the earth is 1370 W m^{-2} with the distance (d_E) 1.5×10^8 km from the Sun, having the albedo $A_E = 0.30$. Calculate the effective temperatures of Ω and earth. *Stefan's constant,* $\sigma = 5.7 \times 10^{-8}$ *W* m^{-2} K^{-4},

8. Write short notes on any three of the following.

   (a) Polar areas are cold.
   (b) Meteorological instruments are classified into two major types.
   (c) The moist adiabatic lapse rate is less than the dry adiabatic lapse rate.
   (d) Solar constant and Albedo of a planet.

-------END-------