The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc/ B. Ed Degree Programme

Department	: Physics
Level	: 5
Name of the Examination	: Final Examination
Course Code and Title	**: PYU3162 - Atmospheric Physics**
Academic Year	: 2019/2020
Date	: 31st December 2019
Time	: 9.30 a.m. -11.30 a.m.
Duration	: Two (2) hours

General Instructions

1. Read all instructions carefully before answering the questions.

2. This question paper consists of **6** questions in **4** pages.

3. Answer any **4** questions only. All questions carry equal marks.

4. Answer for each question should commence from a new page.

5. Draw fully labelled diagrams where necessary

5. Relevant log tables are provided where necessary.

6. Having any unauthorized documents/ mobile phones in your possession is a punishable offence

7. Use blue or black ink to answer the questions.

8. Circle the number of the questions you answered in the front cover of your answer script.

9. Clearly state your index number in your answer script

$Cp = 1004 \ Jkg^{-1}K^{-1}$ $R_d = 287 \ J \ K^{-1} \ kg^{-1}$ $\varepsilon = 0.622$

Wien's displacement constant $= 2.897 \times 10^{-3}$ meter-kelvin

Answer 4 questions only.

01.

    (a) Derive the expression for the variation of pressure with height using a graph which redrawn for the logarithmic value of pressure.

    (b) The cruising altitude of subsonic and supersonic aircrafts are   12 km and 20 km respectively. What is the relative difference in air density between these 2 altitudes?

    (c) Define geopotential (Φ) and geopotential height (Z).

    (d) A deep column of air is in hydrostatic balance. If the air below a certain level H in the column cools, while the air above level H remains at the same temperature, will the pressure at level H increase, decrease or remain unchanged? Explain the answer

02.

    (a) Briefly describe how the air temperature changes from the earth's surface to the lower thermosphere based upon the atmospheric layers.

    (b) How does the Magnetosphere help to protect life on Earth?

    (c) Briefly describe how Auroras form.

    (d) State the four main ways how charged particles produced in the atmosphere?

03.

    (a) What are the main assumptions in air parcel theory?

    (b) State the first law of thermodynamics and its differential equation form defining the symbols used.

    (c) Derive the equation for potential temperature

    (d) An aeroplane was filled with air from the environment while flying at a level 300 mb, keeping the cabin pressure constant at 800 mb. At that height, the environment temperature was around -50° C. Assuming no heat exchange with the surrounding, what could be the new temperature of the cabin of the aircraft?

04.

    (a) Define the solar constant.

(b) Describe the three processes which affect the radiation in the earth's atmosphere.

(c) State the Wein's displacement law.

(d) What are the peak energy emission wavelengths of Sun and Earth assuming their temperatures, 5780 K and 287 K respectively? Which parts of the Electromagnetic spectrum are those in?

05.

(a) What is the difference between dew point and Relative humidity?

(b) Define the term saturation mixing ratio? State an expression for the relative humidity in terms of vapor pressure.

(c) Explain why hot weather causes more human discomfort when the air is humid than when it is dry

(d) Calculate the saturation mixing ratio and specific humidity for air of temperature 0 °C and pressure 50 kPa. The vapour pressure and saturated vapour pressure at 0 °C are 0.611 kPa and 0.603 kPa respectively. Indicate the units.

06.

(a) What is a thermodynamic diagram?

(b) What are the main set of lines or curves used in the complete thermodynamic diagram and briefly explain those?

(c) What are the desirable characteristics of a thermodynamic diagram?

(d) State main characteristics of a stuve diagram.