

**FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA**  
**SCHOOL OF NATURAL AND APPLIED SCIENCES**  
**DEPARTMENT OF GEOGRAPHY.**

**Second Semester Examination 2012/2013 Session**

**Course:** MET 522 (Advanced Topics in Atmospheric Dynamics) 3 Units

**Instructions :** Answer any FOUR questions. The use of relevant diagrams, illustrations and equations will be rewarded.

**Time Allowed:** 3 hours

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1. (a) What is weather forecasting?  
(b) Discuss the steps required in weather forecasting and identify the problems associated with it in the tropics.  
(c) In a tabular form, itemize the basic forecasting rules that may be applied when making a short-range local weather forecast.
2. (a) List the methods that you could use to predict the movement of surface pressure systems and fronts  
(b) Discuss the various types of forecast in Meteorology.
3. Explain the following:
  - (i) Towering cumulus clouds containing large amounts of super cooled water can sometimes be induced to grow higher levels by seeding them with artificial ice nuclei.
  - (ii) A parcel of air cools when it is lifted
  - (iii) Warm air advection signifies instability of the atmosphere while cold air advection signifies stability of the atmosphere.
  - (iv) When the sun heats the wet ground, wisps of cloudy air sometimes form above the layer close to the ground.
  - (v) Rain areas tend to be associated with convergence in the lower troposphere and divergence in the upper troposphere.
4. (a) State the condition(s) for the atmosphere to be in a hydrostatic balance  
(b) State the hydrostatic equation and explain all the terms of the equation  
(c) Suppose at the surface, a 1000m thick layer of air (under standard conditions) has average density of  $1.1 \text{ Kg m}^{-3}$  and an acceleration of gravity  $9.8 \text{ ms}^{-2}$ . Compute the rate of change of pressure with height.
5. (a) Briefly explain the processes that takes place when a hail drop transformed from its solid state to a vapour state.  
(b) Calculate the quantity of heat involved when a 2Kg mass of hail stones initially at  $-10^{\circ}\text{C}$  vapourizes completely.  
(Latent heat of fusion of ice =  $2.34 \times 10^6 \text{ JKg}^{-1}$ , Specific heat capacity of water =  $4.2 \times 10^6 \text{ JKg}^{-1}\text{K}$ , Latent heat of Vapourization of water =  $2.5 \times 10^6 \text{ JKg}^{-1}$ ).
6. Write short notes on any three of the following
  - (i) The use of pressure as a vertical coordinate in atmospheric dynamics
  - (ii) Vertical profiles of pressure, temperature and density
  - (iii) Geopotential
  - (iv) Potential temperature
  - (v) Meteorological codes.