FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND SCIENCE EDUCATION
DEPARTMENT OF GEOGRAPHY

FIRST SEMESTER 2010/2011 SESSION UNDERGRADUATE EXAMINATION

COURSE CODE: MET 515 (3 Units)
COURSE TITLE: Numerical Models in Weather Prediction
INSTRUCTIONS: Answer any 4 questions

TIME ALLOWED: 2½ Hours

1. (a) Explain what is meant by Kinematic Vorticity (ζ) and Divergence in the atmosphere.

    (b) Derive the expression for ζ and Divergence for purely horizontal motions in the **i,j,k** unit vector spaces.

2. Given any wind chart, outline and explain the steps necessary for the graphical estimation of forecast Kinematic Vorticity ($\zeta_{t=1+\Delta t}$), using a 5-point lattice.

3. (a) Using the formula

    $$\zeta = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}$$

    and the geostropic approximations

    $$u_g = -\frac{1}{\rho f}\frac{\partial p}{\partial y} ; \&$$

    $$v_g = \frac{1}{\rho f}\frac{\partial p}{\partial x}$$

    derive the equation of Geostropic Vorticity (ζ_g)

    (b) Explain which latitudinal zone of the world is most suitable for the application of ζ_g and why.

4. Using the formula for atmospheric waves over West Africa

    $$U - C = \frac{\beta L^2}{4\pi^2}$$

    (i) Explain each term in the equation
    (ii) Explain the conditions for the emergence of different weather systems, considering the different values of C and (U-C).

5. Explain how the Duct, Bridge and Drift conditions in the Obasi Model for East Africa could be used in making weather forecast for the region.

6. Discuss the Barotropic Model of the atmosphere and explain why it is suitable for the tropics.