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

FIRST SEMESTER 2012/2013 SESSION UNDERGRADUATE EXAMINATION

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

TIME ALLOWED: 3 Hours

1. Define the Eulerian and Lagrangian changes and explain how the 2 could be connected.

2. Given the following:

$$\nabla = \partial/\partial x \mathbf{i} + \partial/\partial y \mathbf{j} + \partial/\partial z \mathbf{k}; \quad and \quad V = u\mathbf{i} + v\mathbf{j} + w\mathbf{k}$$

Derive the expressions for Convergence and Divergence and explain the significance of each in weather development

3. (a) Given the following values of geopotential height H on grid points around a point O:

$$H_0 = 3124, H_1 = 3160, H_2 = 3140, H_3 = 3050, H_4 = 3140, \text{ Compute}$$

$$\zeta_g = \frac{4g}{fd^2}\left(\overline{H} - H_o\right)$$

(Assuming $g = 10 m/s^2$, $f = 10^{-4}/s$ and $d = 2.22 \times 10^5$)

(b) How is this method effectively used in weather forecasting in the middle latitudes?

4. Explain the steps necessary for the graphical estimation of Kinematic Vorticity (ζ_k) and state the latitudinal region to which it is mostly applied and why it is used for the region.

5. Using the Duct and Bridge conditions in the Obasi Model for East Africa, explain how each is used in determining weather changes in the region.

6. Using the Rossby Wave equation:

$$L = 2\pi \sqrt{\frac{U - c}{\beta}}$$

Explain how weather systems over West Africa could be categorized by strength, in terms of wave numbers.