2017

M.Sc.

3rd Semester Examination

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER—MTM-303(OM)

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

(Dynamical Oceanography and Meteorology)

Answer *Q. No. 1* and any *four* questions from the rest.

1. Answer any *four* questions : 4×2

   (a) Show the directions of rotation of cyclonic around low-pressure and high-pressure regions in northern and southern hemispheres.

(b) State the basic laws of physics which are taken as axiomatic in developing the study of the dynamics of the ocean.

(c) Show the contour plot of density as a function of temperature and salinity over ranges appropriate to most of the ocean.

(d) Show that the pressure tendency at the earth surface becomes zero when the air motion at all levels in the atomosphere is geostrophic.

(e) Derive the hydrostatic equation in the atmosphere.

(f) What is coriolis force ?

2. (a) Define concentration of a solution quantitatively in four possible ways.

(b) Write the governing equations of motion in oceanography and indicate terms involved in the equations.

(c) Combine the Coriolis terms acting on the horizontal plane into and single term and then calculate its

magnitude at different latitude ϕ = 90°, 45° and 30° for a current speed of 1 ms^{-1}. 4+2+2

3. (a) Derive the expression for geopotential distance between two levels z_1 and z_2.

(b) Write the transformation in vector form ideal axes fixed in space to axes fixed to earth, then using this transformation derive the equation of motion in axes fixed to earth. 4+4

4. Derive the Reynolds equation for the x-component of velocity. 8

5. (a) Derive the momentum equation of motion of an air parcel in the atmosphere in the Cartesian co-ordiante system. 7

(b) State first law of thermodynamics. 1

6. (a) What is thermal wind in the atmosphere ? Derive the equation of thermal wind. 7

7. (a) Find the rate of change circulation in the atmosphere and interpret each term. 7

(b) Derive dry adiabatic lapse rate of temperature in the atmosphere. 1

[Internal Assessment—10 Marks]