2022

B.A./B.Sc.

Sixth Semester

DISCIPLINE SPECIFIC ELECTIVE – 4

PHYSICS

Course Code: PHD 6.21 (B)

(Atmospheric Physics)

Total Mark: 70   *Pass Mark: 28*

Time: 3 hours

Answer <u>five</u> questions, taking <u>one</u> from each unit.

UNIT–I

1. (a) Define potential temperature. Derive the required expression for the dry adiabatic lapse rate.   1+4=5

    (b) Derive Clausius-Clapeyron equation. Explain different layers of the Earth atmosphere with appropriate diagram.   5+4=9

2. (a) What is greenhouse effect? Explain the four main types of local wind with appropriate figures.   1+6=7

    (b) Define monsoon. Write a short note on cyclones and anticyclones.
                                                            1+6=7

UNIT–II

3. (a) Show that Coriolis force per unit mass is given by $F_{cor} = -2\Omega \times V$, where $V = u\hat{i} + v\hat{j} + w\hat{k}$ and $\Omega = \Omega\cos\phi\hat{j} + \Omega\sin\phi\hat{k}$.   8

    (b) Derive the expression for the resulting frictional force component per unit mass in the three Cartesian coordinates direction.   6

4. (a) Show that the acceleration following the relative motion in the rotating frame is equal to the sum of the Coriolis force, the pressure gradient force, effective gravity and friction, that is,

    $$\frac{DU}{Dt} = -2\Omega \times U - \frac{1}{\rho}\nabla_p + g + F_r$$ 5

(b) Define vorticity. Derive the relationship between vorticity and circulation. 1+4=5

(c) Prove that the continuity equation in an isobaric system is given by

$$\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}\right)_{p}+\frac{\partial w}{\partial p}=0$$

4

UNIT–III

5. (a) Explain surface water waves. Distinguish between deep-water wave and shallow water wave with respect to depth of water and wavelength of the wave. 6

(b) If the water depth of an ocean is about 3000 m, what will be the speed of a tsunami with a wavelength of 100 km? 2

(c) Explain atmospheric gravity waves and derive its velocity expression for both deep and shallow wave. 6

6. (a) Write short note each on Lamb and acoustic waves. 7

(b) Define Rossby waves. Derive its equation for propagation in three dimensions. 1+6=7

UNIT–IV

7. (a) Derive the simplest form of the radar equation. Explain prediction range performance and maximum detectable signal by a radar. 5+2+2=9

(b) Explain the working principle of a pulse-radar with the help of a block diagram. 5

8. (a) Write a table for the standard radar frequency bands. Explain CW radar with the help of a block diagram. 3+5=8

(b) Define LIDAR. Explain the working principle of LIDAR. 1+5=6

UNIT–V

9. (a) Explain the spectral distribution of the solar radiation with appropriate figure. 4

(b) What are aerosols? Write a short note on classification and properties of aerosols.   1+3+3=7

(c) Discuss the three main removal mechanism of aerosol.   3

10. (a) Explain in detail the absorption and scattering of solar radiation by the atmosphere.   5

(b) Define Dougeur-Lambert law. Explain the principles if measurement of radiometry.   1+4=5

(c) Explain any two optical phenomena in our earth's atmosphere.   2+2=4

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