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Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, March 2025

Physics With Specialization In Spacephysics

PHSP 534 : PHYSICS OF THE ATMOSPHERE

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 75

PART – A

Answer any **five** questions. Each question carries **3** marks.

1. Discuss the chemical composition of the atmosphere.

2. What is potential temperature, and why is it a useful parameter in atmospheric science?

3. Briefly describe the Quasi-Biennial oscillation (QBO) and its role in atmospheric dynamics.

4. Sunlit objects appear reddish around sunrise and sunset on days when the air is relatively free of aerosols. substantiate the statement.

5. Ilustrate the Brewer-Dobson circulation and analyze its role in ozone transport within the stratorsphere.

6. Describe the use of SODAR's for atmospheric studies.

7. What is a barotropic model in numerical weather prediction?

8. Explain the difference between seasonal climate variability and annual mean conditions.

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer **three** questions. Each question carries **15** marks.

9. (a) How does the atmospheric temperature varies with altitude? Explain how the atmosphere is divided based on this.

   (b) If the globally averaged surface pressure is 970 hPa, find the mass of the atmosphere.

OR

10. (a) Discuss the concept of static stability in the atmosphere. Explain the condition for positive static stability and negative static stability for unsaturated air.

    (b) Analyse how static stability changes under conditions of conditional and convective instability. What is LFC and LCL?

11. (a) Explain the physics of the scattering and absorption of particles in the atmosphere.

    (b) Derive the equation for radiative transfer in planetary atmospheres.

OR

12. (a) Examine the dynamics of the horizontal flow of air.

    (b) Analyze the impact of friction, pressure gradient force, and Coriolis force on the horizontal flow.

13. (a) Examine the processes driving internally generated climate variability and explain their impact on global and regional climates.

    (b) Discuss the interplay between externally forced climate variability and internal climate processes. How do these interactions shape long-term climate trends?

OR

14. (a) Discuss the instruments RADARS, LiDARS and radiometers used for atmospheric observations.

(b) Highlight the advantages of satellite remote sensing in weather and climate studies.

(3 × 15 = 45 Marks)

PART C

Answer any **three** questions. Each question carries **5** marks.

15. What is meant by scale height of the atmosphere in terms of pressure? At approximately what height above sea level does half the mass of the atmosphere lie above and the other half lie below? (Assume scale height as 8 km).

16. Calculate the geopotential height of 1000 hPa pressure surface when the pressure at sea level is 1014 hPa. (Assume scale height of the atmosphere as 8 km).

17. Explain the structure and dynamics of the atmospheric boundary layer, highlighting the formation of the daytime convective boundary layer and the nighttime stable boundary layer. Discuss their key characteristics and processes.

18. Compare vorticity and divergence in horizontal atmospheric flow and examine their significance in large-scale dynamics.

19. Describe the concept of hydrostatic balance with the help of equation and evaluate its importance in atmospheric dynamics.

20. Explain the need for parameterization in atmospheric models and describe how it simplifies complex processes.

(3 × 5 = 15 Marks)