國立中央大學109學年度碩士班考試入學試題

所別： 太空科學研究所 碩士班 不分組(一般生)
太空科學研究所 碩士班 不分組(在職生)

科目： 太空物理學

本科考試禁用計算器

＊請在答案卷(卡)內作答

Space Physics: Ionosphere (50 points)

1. Describe the features of the (1) Pedersen (5 points) (2) Hall (5 points) and (3) field-aligned (5 points) conductivity with respect to the altitude throughout the ionosphere.

2. Explain the generation mechanism of (1) auroral electrojet (10 points) and (2) equatorial electrojet (10 points).

3. Describe the (1) diurnal variation (5 points), (2) seasonal variation (5 points), and (3) geographical variation (5 points) of the ionosphere.

參考用

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Space Physics: Magnetosphere (50 points)

4. Please explain
   (a) the existence of equilibrium plasma sheet and plasmasphere based on the equilibrium state of MHD momentum equation. (8 points)
   (b) the frozen-in condition qualitatively and illustrate the properties in the low-beta and high-beta plasma. (8 points).

5. Please discuss
   (a) the possible mechanisms of a particle entering into the loss cone from the first adiabatic invariant. (4 points)
   (b) the Alfvén layer of hot electrons on the equatorial plane affected both by solar wind convection and gradient B drift motion. (6 points)
   (c) the direction of cross-tail current based on the particle and fluid points of view. (10 points)

6. Assuming that the Earth's magnetic field is a dipole field,

$$\vec{B} = -\frac{B_0 R_E^3}{r^3}\left(2\cos\theta\hat{r} + \sin\theta\hat{\theta}\right),$$

where r is the radial distance, θ is the colatitude, B_0 is the equatorial magnetic field strength on the surface, and R_E is Earth radius. If the mirror point is roughly at 1 R_E,
(a) find the relationship between the latitude λ of mirror point and L using the definition of L value. (4 points)
(b) determine the magnetic field strength at the mirror point in terms of B_0 and L. (10 points)