國立臺灣大學101學年度碩士班招生考試試題

1. (20%) An airplane has a top speed of 100m/s. Magnitudes of the acceleration and deceleration is limited to 2m/s^2. What is the minimum time required for a trip of 100km.
2. (20%) A ship is moving at 5m/s relative to the water in a uniform current flowing east at 2m/s. If the captain wants to sail northwest relative to the earth, what direction should she point the ship? What will be the resulting magnitude of the ship's velocity relative to the earth?
3. (20%) The radius of the earth is R_e. A spacecraft at a distance $r_0 = 2R_e$ from the center of the earth is moving with initial velocity $v_0 = \sqrt{2gR_e/3}$ away from the earth. Determine its velocity as a function of its distance from the center of the earth.
4. (20%) The radius of the earth is $R_e = 6370\text{km}$. When a satellite is a the point at which it is nearest to the earth, the magnitude of its velocity is $v_p = 7000\text{m/s}$, and its distance from the center of the earth is $r_p = 10,000\text{km}$. What are the magnitude of its velocity and its distance from the earth at the point at which it is farthest from the earth?
5. (20%) A ship is moving north at a constant speed of 15.0m/s relative to the earth and it is turning toward the west at a constant rate of 5.0 degrees per second. Relative to the ship's coordinate (the ship coordinate is defined in Fig. 1), its radar indicates that the position, velocity, and acceleration of a helicopter are: $\mathbf{r} = 420.0\mathbf{i} + 236.2\mathbf{j} + 212.0\mathbf{k}(\text{m})$; $\mathbf{v} = -53.5\mathbf{i} + 2.0\mathbf{j} + 6.6\mathbf{k}(\text{m/s})$; $\mathbf{a} = 0.4\mathbf{i} - 0.2\mathbf{j} - 13.0\mathbf{k}(\text{m/s}^2)$. What are the helicopter's velocity, acceleration relative to the earth?

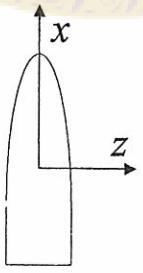

Figure 1 Ship's coordinate

試題隨卷繳回