1. 請用中文解釋題意後，回答問題。  
Set up a basic block diagram for a position control system in which an electric motor must control angular shaft position. A potentiometer is used to measure the position.

2. 請用中文解釋題意後，回答問題。  
A differential equation approximating the rotational dynamics of a rigid vehicle moving in the atmosphere is

$$ J \frac{d^2 \theta}{dt^2} - N L \theta = T $$

where $\theta$ is the vehicle attitude angle, $J$ is its inertia, $N$ is the normal-force coefficient, $L$ is the distance from the center of gravity to the center of pressure, and $T$ is any applied torque. Determine the transfer function between an applied torque and the vehicle attitude angle.

3. What is the transfer function of a system whose input $u$ and output $y$ are related by the following differential equation?  

$$ \frac{d^2 y}{dt^2} + 3 \frac{dy}{dt} + 2y = u + \frac{du}{dt} $$

Does this transfer function represent a stable or an unstable system?  

4. Find the unit step response of a system having the transfer function

$$ P(s) = \frac{4}{(s^2 - 1)(s^2 + 1)} $$

$$(10\%)$$
5. Explain the sensing theory of an optical sensor and its applications in automatic systems. (10%)

6. Explain CAD and CAM technologies for machining mechanical parts. (10%)

7. Illustrate the typical configuration of a PLC-based pneumatic control system and state the application features. (15%)

8. Express main components and advantages of an AS/RS for an automated factory. (15%)