總分為 100 分，題號請標示清楚。

一、光電式近接感測開關之感測原理為何？依架構差異可分為那幾類型？(10%)。

二、電磁式近接感測開關之感測原理為何？其在自動控制上之應用特性為何？(10%)。

三、試述 PLC 的主要組成架構與應用特點。(10%)

四、試述半導體通訊協定 SECS-I/SECS-II 之意義與重要性。(10%)

五、試說明 RFID 之原理與其在製造自動化上之應用為何。(10%)
Six. (1) Explain the operation of ordinary traffic signals which control automobile traffic at roadway intersections. (5%) 
(2) Why are they open-loop control systems? (5%) 
(3) How can traffic be controlled more efficiently? (5%) 

Seven. A differential equation describing the dynamic operation of the one-degree-of-freedom gyroscope shown below is \( X(d^2\theta/dt^2) + B(d\theta/dt) + K\theta = H_0 \), where \( \omega \) is the angular velocity of the gyroscope about the input axis, \( \theta \) is the angular position of the spin axis—the measured output of the gyroscope, \( H \) is angular momentum stored in the spinning wheel, \( J \) is the inertia of the wheel about the output axis, \( B \) is the viscous friction coefficient about the output axis, and \( K \) is the spring constant of the restraining spring attached to the spin axis. 

(1) Determine the transfer function relating the Laplace transforms of \( \omega \) and \( \theta \). This type of gyroscope is called a rate gyro. Show that the steady state output is proportional to the magnitude of a constant rate input. (10%) 
(2) Determine the transfer function between \( \omega \) and \( \theta \) with the restraining spring removed (\( K = 0 \)). This type of gyroscope is called an integrating gyro. Show that the output is proportional to the integral of the input rate. (10%) 
(3) 請用中文翻譯題意及問題(附圖不用翻譯)。(15%)