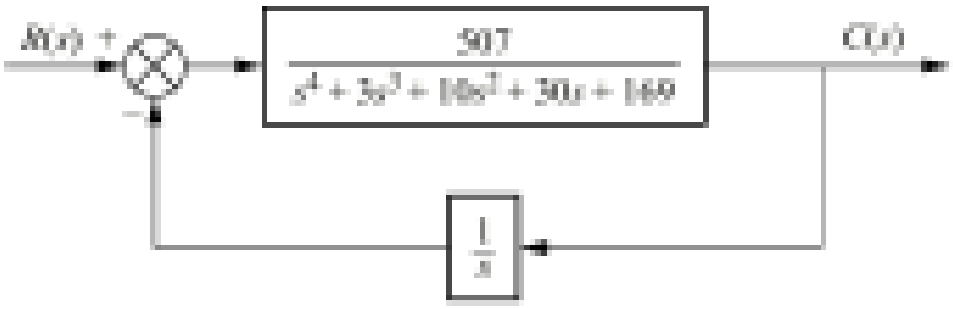
國立嘉義大學九十七學年度

生物機電工程學系碩士班(乙組)招生考試試題

科目：自動控制　　（※禁止使用計算機）

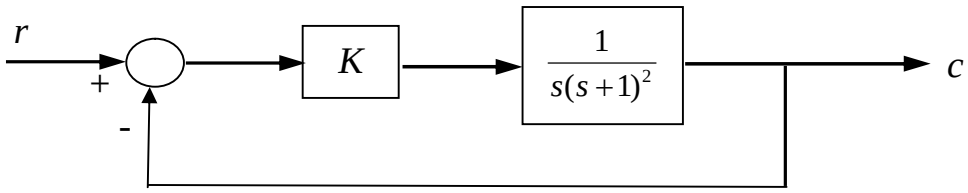
1. Given the block diagram model as shown in the following figure,



   (a) Find the system transfer function. (10%)
   (b) Using the Routh-Hurwitz criterion, find out how many closed-loop poles of the system lying in the left half-plane, in the right half-plane, and on the *jw*-axis. (15%)

2. For the system represented by the differential equation $c^{(3)}(t)+3c^{(2)}(t)+2c^{(1)}(t)+4c(t)=4\,r(t)$, where $r(t)$ represents the reference input.
   (a) By means of the signal-flow graph and Mason's theorem, find the transfer function of the closed-loop system, $C(s)/R(s)$. (16%).
   (b) Also determine the phase-variable form of the state and output vector equations for the system. (9%)

3. Given the feedback control system:



   (a) Find the range of the gain K for stability of the closed-loop system. (10%)
   (b) If $K=2$, what is the frequency (rad/sec) of the oscillation for transients? (5%)
   (c) If $K=1$, find the steady-state error (i.e. input minus output) when the input r is a unit step function. Does this unit step response exhibit an overshoot of the steady state output? (5%)
   (d) If $K=1$, find the steady-state error for a unit ramp input. (5%)

4. Given an unity feedback system

$$KG(s)=\frac{K}{s(s^2+6s+12)}$$

   (a) Sketch the Bode plot (10%)
   (b) Determine the range of the gain K which can make the system stable. (5%)
   (c) Determine K and the natural frequency ω_n if the damping ratio (ξ) is 0.5 of the closed-loop system. (10%)