Control theory I	Second Exam (Fall 2020-2021)	Date 03/04/2021 Time : 1:15 hour

***Q1** (4 points).* For the closed loop control system shown in figure (*1*), if $r(t)$ is a step input:

- Find the value of K_1 and K_2 that gives a peak time of 1 second and a setting time (5%) of 2 seconds.
- Find also the value of the rise time and the maximum overshoot.

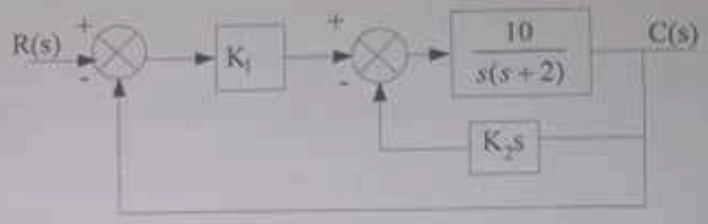

Figure (*1*)

***Q2** (4 points).* The time response of the open loop second order system $G(s)=\dfrac{A}{s^2+Bs+C}$ to a step input of amplitude 8 is given in figure (2).

Find the value of the parameters A, B and C.

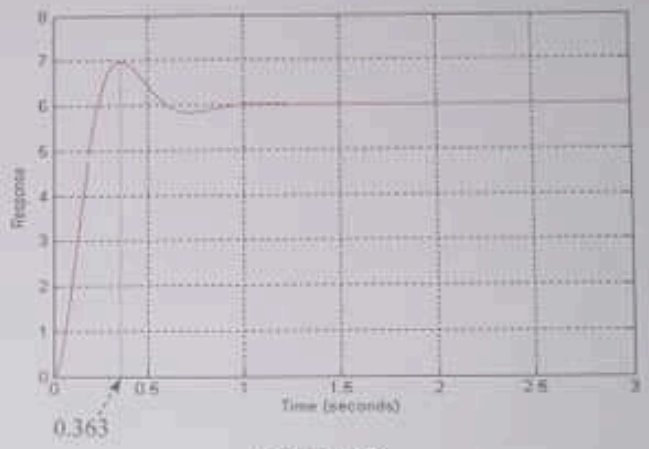

Figure (*2*)

***Q3** (4 points).* Consider the open loop system described by the transfer function *G(s)* and configured as in the block diagram of figure (*3*). If the input signal is given as $u(t)=15\sin 2t$

and $G(s)=\dfrac{(s+5)}{(s+1)(s+2-j5)(s+2+j5)}$.

(a) Is this system is a stable system? Why?
(b) If the system is stable, find the response of this system as a function of time ($y(t)$).

Figure (*3*)

***Q4** (4 points).* Consider the system described by the block diagram of figure (*1*) with $G(s)=\dfrac{1}{s^2+2s+7}$ and $H(s)=2$.

(a) Find the overall transfer function of this system.
(b) If the input function is a unit step function, find :
- The rise time of the response signal.
- The peak time of the response signal.
- The maximum overshoot of the response signal.
- The setting time for an allowable tolerance of 5%.
- Draw approximately the response of the system.

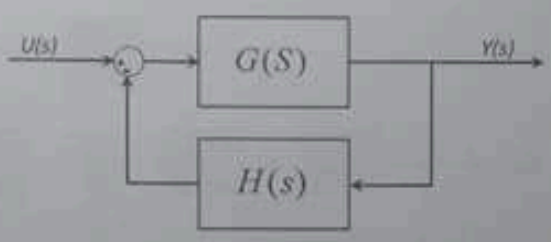

Figure (*4*)