1、 $c(t) = 10 - 12.5 \cdot e^{-1.2t} \cdot \sin(1.6t + 53.1°)$

$= 10[1 - 1.25 e^{-1.2t} \cdot \sin(1.6t + 53.1°)]$

由于系统为二阶系统，故 $\frac{1}{\sqrt{1-\zeta^2}} = 1.25$，$\zeta\omega_n = 1.2$，

$\omega_d = 1.6$，$\theta = 53.1°$

解得 $\zeta = 0.6$，$\omega_n = 2$

$\sigma_p = e^{-\pi\zeta/\sqrt{1-\zeta^2}} \times 100\% = 9.48\%$

$t_p = \frac{\pi}{\omega_d} = 1.96s$

设误差限 $\Delta = 0.05$，$t_s = \frac{3}{\omega_n\zeta} = 2.5s$

设 $\Delta = 0.02$，$t_s = \frac{4}{\omega_n\zeta} = 3.33s$

2、(1)、系统传递函数 $M(s) = \frac{G(s)}{1 + K_f G(s)} = \frac{\frac{K_i K_a K_m}{R_f s(Js+f)}}{1 + \frac{K_i K_a K_m K_f}{R_f s(Js+f)}}$

$= \frac{K_i K_a K_m}{R_f J s^2 + R_f f s + K_i K_a K_m K_f}$

$= \frac{6000}{s^2 + 10s + 6000}$

系统为二阶系统，$\omega_n^2 = 6000$，$2\zeta\omega_n = 10$，得 $\omega_n = 77.46$，$\zeta = 0.0645$

$\theta = \arccos\zeta = 86.3°$，$\omega_d = \omega_n\sqrt{1-\zeta^2} = 77.30$

$\theta(t) = 1 - \frac{1}{\sqrt{1-\zeta^2}} e^{-\zeta\omega_n t} \sin(\omega_d t + \theta) = 1 - 1.002 e^{-5t} \sin(77.3t + 86.3°)$

(2)、系统的特征方程为：$s^2 + 10s + 6000 = 0$，劳斯表如下：

s^2	1	6000
s	10	
s^0	6000	

系统稳定

$\theta_d(t)=0$，$n(t)=1(t)$ 时，$N(s)=\frac{1}{s}$

$\frac{\Theta(s)}{N(s)}$

$$E(s)=-K_f\Theta(s)=-K_f\frac{-\frac{1}{s(Js+f)}}{1+\frac{K_a K_m K_f}{R_f s(Js+f)}}N(s)=\frac{1}{s(0.1s^2+s+600)}$$

$$e_{ss}=\lim_{s\to 0}sE(s)=\frac{1}{600}$$

(3)、$n(t)=0$，$\theta_d(t)=t$，$t>0$ 时，$R(s)=\frac{1}{s^2}$

$$e_{ss}=\lim_{s\to 0}s\frac{R(s)}{1+G(s)H(s)}=\lim_{s\to 0}\frac{0.1s+1}{0.1s^2+s+600}=\frac{1}{600}$$