Registration no: | | | | | | | | | | |

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B.TECH
PCEC4303

5th Semester Regular / Back Examination 2015-16
CONTROL SYSTEM ENGINEERING
BRANCH: EC,ETC
Time: 3 Hours
Max marks: 70
Q.CODE: T371

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) In a signal flow graph, what is the difference between path gain and loop gain?
b) What do you understand by regenerative feedback?
c) Draw the speed torque characteristic of Induction motor used for AC Servomotor.
d) Draw the time response of second order system to ramp input.
e) Define Hurwitz stability criterion.
f) Give an example of physical system with transportation lag.
g) For a stable system both Gain Margin and Phase Margin should be positive. Justify the statement.
h) What are M circles and N circles?
i) What is the phase angle for the transfer function $G(s) = \frac{1}{(1+sT)^4}$ at corner frequency?
j) Write Mason's Gain formula.

Q2 **a)** The forward path gain of a first-order negative feedback system is, $G(s) = \frac{K}{s+a}$. The unit step response reveals that the time constant is 0.1667. When the location of the open-loop pole is moved towards the origin by half its distance, the new time constant is found to be 0.25 second. Evaluate 'a' and 'K'. For the time constant to be 0.125 second, find the location of the open-loop pole. **(5)**

b) A second-order system is represented by the transfer function, $\frac{C(s)}{R(s)} = \frac{180}{s^2+19.6s+196}$. Find the value of damping ratio, natural and damping frequency of oscillation and time constant for the decaying envelop. **(5)**

Q3 **a)** A unity feedback system has $G(s) = \frac{K}{[s(1+Ts)]}$. When subjected to unity step input, it shows 30% peak overshoot while it shows resonant frequency of 10 rad/sec in frequency domain. Calculate K and T. **(4)**

b) Also calculate (i) gain cross over frequency, (ii) phase cross over frequency and (iii) resonant peak. **(6)**

Q4 For the system represented by the following equations, find the transfer function $X(s)/U(s)$ by signal flow graph technique. **(10)**

$$x = x_1 + \alpha_3 u$$
$$\dot{x}_1 = -\beta_1 x_1 + x_2 + \alpha_2 u$$
$$\dot{x}_2 = -\beta_2 x_1 + \alpha_1 u$$

Q5 Draw the Nyquist plot and discuss the stability of the system given by $G(s)H(s) = \frac{4(s-1)}{s+2}$. **(7+3)**

Q6 A system has $G(s)H(s) = \frac{K}{[s(1+s)(1+0.1s)(1+0.02s)]}$. Determine the value of K so that (i) gain margin is +10dB, (ii) phase margin=+25^0. **(5+5)**

Q7 Draw polar plot of $G(s)H(s) = \frac{50}{(s+1)(s+2)(s+3)}$ and determine whether the system is stable or not. If the system is stable, determine the gain margin and phase margin of the system. **(4+1+5)**

Q8 Write short notes on any two: **(5 x 2)**

a) Synchros
b) Rules of construction of Root Locus
c) Effect of negative feedback on sensitivity, bandwidth and Disturbance.
d) Constant M-circles.