Registration no:

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B.TECH
PCEC4303

5th Semester Regular / Back Examination 2016-17
CONTROL SYSTEM ENGINEERING
BRANCH(S): ECE, EEE, ELECTRICAL, ETC
Time: 3 Hours
Max Marks: 70
Q.CODE: Y439

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) Draw the signal flow graph for a given Transfer function: $T(s) = \frac{4}{s^2+6s+11}$.

b) Determine the stability of the system given as: $T(s) = \frac{2s-4}{s^2+s-6}$.

c) In a signal flow graph, define feedback loop, self loop and Non-touching loop.

d) Define Nyquist Contour ?

e) In root locus technique, what is the difference between the breakaway point and asymptotic point.

f) What is the difference between encirclement and enclosement?

g) How many roots of a given polynomial are in the right half of the complex plane?
$0.3s^4 + 1.1s^3 + 0.7s^2 + s + 3.1$

h) How to improve the speed torque characteristic of a two-phase induction motor used for AC Servomotor.

i) What is the effect of negative feedback on Bandwidth and Disturbance?

j) For a second order system with transfer function $T(s) = \frac{200}{s^2+3s+13}$, determine the undamped natural frequency, the damping ratio and the oscillation frequency .

Q2 **a)** The open loop transfer function of a unity feedback system is $G(s) = \frac{K}{s(sT+1)}$, where K and T are constants. How many times the gain should be increased to increase the overshoot from 50% to 60%. **(5)**

b) The open loop transfer function of a servo system with unity feedback is $G(s) = \frac{20}{s(0.1s+1)}$ **(5)**
Evaluate the static error constants and obtain the steady state error of the system when subjected to an input of

$$r(t) = A_0 + A_1 t + \frac{A_2}{2} t^2$$

Q3 **a)** For the system given by the characteristic equation $s^3 + 6s^2 + 10s + 12.4 = 0$. Determine the location of the roots by shifting the origin of the s-plane by one unit to left and applying the Routh's Criterion. **(5)**

b) Consider a unity feedback second order system without an integrator. Justify how the damping ratio is improved with the use of derivative controller. **(5)**

Q4 Draw the log-magnitude asymptotic plot for the transfer function, **(10)**

$$G(s) = \frac{2000s}{(s + 10)(s + 100)}$$

And find (a) the gain crossover frequencies, and (b) the frequencies at 3-dB attenuation.

Q5 **a)** Explain the working principle of A.C Servomotor used for low power application. **(5)**

b) Explain in brief the working of Synchro transmitter. **(5)**

Q6 Construct the root locus for a feedback system with open loop transfer function, **(10)**

$$G(s)H(s) = \frac{K(s + 1)(s + 4)}{s^3}$$

For what value of K, is the system stable?

Q7 A feedback control system has forward path gain $G(s) = \frac{4}{s(s-1)}$ and feedback path gain $H(s) = (s + 1)$. Draw the Nyquist diagram for the system and assess the stability of the closed loop system. **(10)**

Q8 **Answer any two:** **(5 x 2)**

a) Standard test Signals.

b) Constant M-Circles for unity feedback system.

c) PID Controller.

d) Generalized Static Error Coefficient.