Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech**
PCEC4303

5th Semester Back Examination 2019-20
CONTROL SYSTEM ENGINEERING
BRANCH : AERO, BIOMED, CSE, ECE, EEE, ELECTRICAL, ETC, IT, ITE
Time : 3 Hours
Max Marks : 70
Q.CODE : HB505

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) Define Transfer function of the system.

b) Write down the differential equation for the mechanical system shown in figure 1.

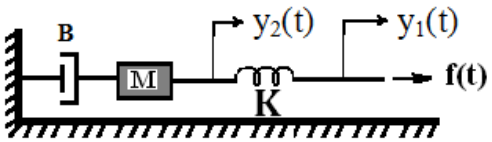

Figure 1

c) Write down Mason's gain formula for determining the transfer function of a signal flow graph.

d) What are the type and order of a system?

e) Find how many unstable roots are there for $q(s) = s^5 + 4s^4 + 8s^3 + 9s^2 + 6s + 2$.

f) Write down the magnitude criterion and the angle criterion for a point to be on the root locus. How is the gain K at a particular location determined?

g) Define gain margin and Phase margin

h) Define the gain crossover frequency and phase crossover frequency.

i) If the system is $G(s) = 4/(s+1)$, find its gain and phase.

j) Explain how the principle of Argument is used to state the Nyquist criterion for stability of linear system.

Q2 **a)** Derive the transfer function of system using block reduction technique. **(5)**

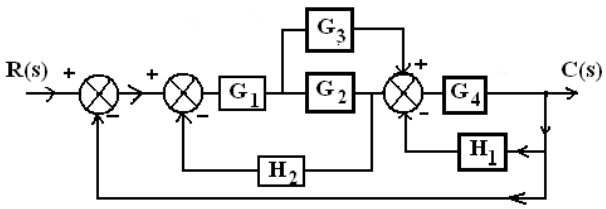

Figure 2

b) Determine C/R of the system shown in Figure 2 Using Mason's gain Formula **(5)**

Q3 **a)** For a feedback system as shown in figure.3, find K_1 and K_2 so that peak overshoot of the system is 1.6% and the corresponding peak time is 1.2 second. **(5)**

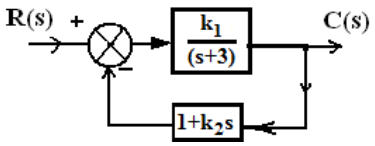

Figure 3

b) Use Routh's criteria to determine the stability of a system, the characteristic equation of which is $3s^4 + 10s^3 + 5s^2 + 5s + 3 = 0$. **(5)**

Q4 **a)** The open loop transfer function of unity feedback system is given by **(5)**

$$G(s)H(s) = \frac{K(s+1)}{s^2(s^2+8s+15)}$$

Find an expression for error E(s) and find the value of K when the steady state error due to a parabolic input is 0.3.

b) The open loop transfer function of a control system is given by **(5)**

$$G(s)H(s) = \frac{K}{s(s+2)(s+4)}$$

Sketch the root locus for $0 \le K \ge \infty$

Q5 **a)** Sketch the polar plot for : **(5)**

$$G(s)H(s) = \frac{K}{s(s+2)^2}$$

b) Determine the Phase crossover frequency and the gain margin for the above system. **(5)**

Q6 Draw the bode plot for the transfer function **(10)**

$$G(s)H(s) = \frac{36(1+0.2s)}{s^2(1+0.05s)(1+0.01s)}$$

Comment on the stability of the system.

Q7 Draw the Nyquist plot of the following system : **(10)**

$$G(s)H(s) = \frac{(s+4)}{(s-1)(s+1)}.$$

Write a comment that closed – loop system is stable or not.

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Synchros

b) Constant M- circle and constant - N circle

c) PID Controller