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

Total Number of Pages: 03 **B.TECH**

PCEC4303

5th Semester Regular / Back Examination 2015-16

CONTROL SYSTEM ENGINEERING

BRANCH(S): EEE,ELECTRICAL

Time: 3 Hours

Max marks: 70

Q.CODE: T163

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

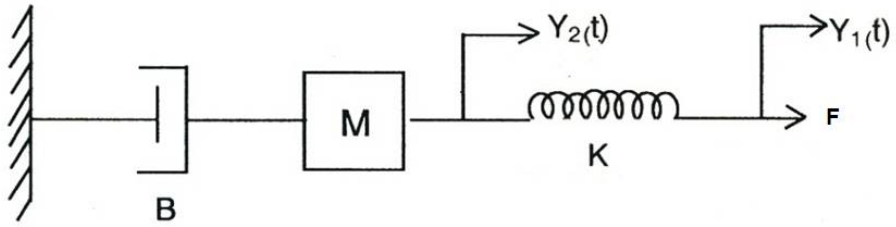
Q1 Answer the following questions: (**2 x 10**)

a) Determine the equivalent spring constant when two springs are connected in series and parallel.

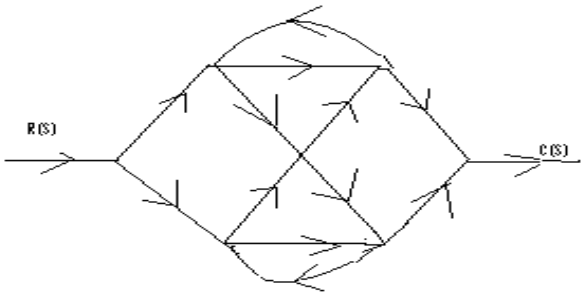
b) Determine the transfer function of the system described by

$5\frac{d^3y}{dt^3} + 4\frac{d^2y}{dt^2} + \frac{dy}{dt} = \frac{du}{dt} + 7u$

c) Write down the differential equation for the system shown in figure



d) Determine the number of loops and forward paths in the signal flow graph shown in figure below.



e) The closed loop transfer function of a control system is given by $\frac{C(s)}{R(s)} = \frac{1}{s+1}$ .For the input r(t)=tsin(t),determine the steady state response c(t).

f) Define 'Gain Margin' and 'Phase Margin'. What significance do they have in frequency domain analysis?

g) Differentiate between 'type' and 'order' of a system. Determine the 'type' and 'order' for the system whose transfer function is given below.

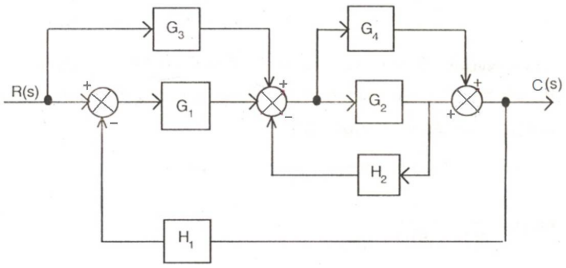
G(s) = $\frac{200(s+2)(s+5)}{s^5(s+10)(s^2+3s+9)}$

h) A unity feedback system has the forward transfer function G(s)=$\frac{16}{s(s+4)}$. What are the resonant frequency and damped natural frequency of the closed loop frequency response system in rad/sec.

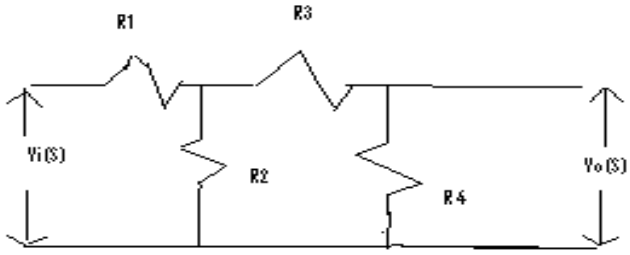
i) A unity feedback system has the following forward transfer function G(s) = $\frac{K(S+10)}{(s+14)(s+15)}$. Determine the appropriate error constant and find the value of K so that there is 0.1% error in steady state.

j) Write down the usefulness of different control actions for a PID controller.

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



b) Find the transfer function of the given electrical network (**5**)



using signal-flow graph analysis.

Q3 **a)** The open loop transfer function of a unity feedback control system is G(s)=$\frac{K}{(1+TS)S}$ Where K and T are constants. Determine factor by which gain 'K' should be multiplied so that overshoot of unit step response be reduced from 75% to 25%. (**5**)

b) A unity feedback control system has the closed loop transfer function (**5**)

G(s) = $\frac{K(S+6)}{s(s+1)^2(s+0.5)}$

Find the value of K so that the steady state error is to be kept less than 0.056 for an input 2+10t.

Q4 Sketch the root locus plot for a feedback system with characteristic equation (**10**)

s(s+2)(s^2 +4s+8)+k= 0

Q5 **a)** For unity feedback system, system is marginally stable and oscillates with frequency 4 rad/sec. Find K_{mar} and 'p' . (**5**)

G(s) = $\frac{4}{s(s^2 +ps+2k)}$.

b) Derive the expression for resonant frequency and resonant peak of a frequency response. (**5**)

Q6 **a)** Draw the Bode Magnitude plot for the following system: (**5**)

G(s) H(s)= $\frac{3(S+1)(S+6)}{s^2\ (s^2\ +18S+400)}$

b) Draw the Phase Plot for the above system and comment on stability. (**5)**

Q7 **a)** For feedback control system (**5**)

G(s) H(s)= $\frac{40}{(s+4)(s^2\ +2s+2)}$

Find Gain margin and stability from Nyquist plot.

b) Draw the polar plot for **(5)**

G(s) H(s)= $\frac{K}{S(S+5)^2}$

Q8. **Write Short notes on any two of the following.** **(5x2)**

a)AC Servomotor

b) constant M and N circle

c)Propotional, Integral and Derivative Controllers

d)Syncro