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

Total Number of Pages: 03

B.Tech
PCEI4303

6th Semester Regular / Back Examination 2015-17
CONTROL SYSTEMS
BRANCH: AEIE, EIE, IEE
Time: 3 Hours
Max Marks: 70
Q.CODE: W194

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)**

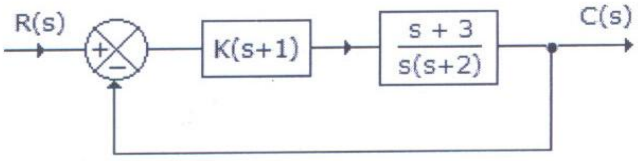
a) How can the output of an open loop system be controlled?

b) In which type of control system the control action depends on the output of the system?

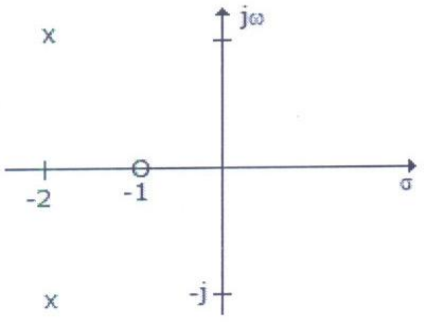
c) Name two different control system components which can be used as sensors or error detectors.

d) In force current analogy, the capacitor of a system can be considered as equivalent with which control component.

e) The block diagram of a system is given in the following figure. Find out the characteristic equation of the given system.



f) The pole zero plot of a system is given in the following figure. Considering the steady state gain of the system to be 2.5, determine the transfer function of the system.

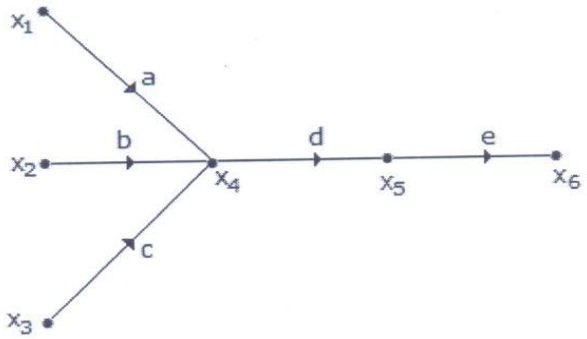


g) First column elements of Routh's array are 3, 5, $\frac{-3}{4}$, $\frac{1}{2}$, 2. Determine the location of different roots of the system in s-plane.

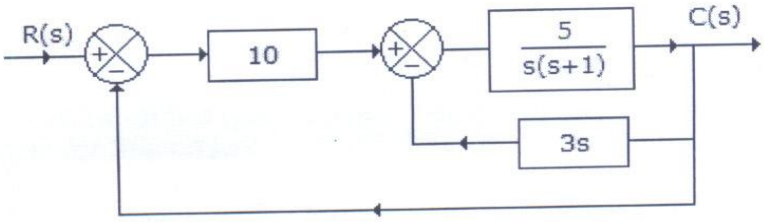
h) What the nature is of Bode diagram for the constant gain K of a system.

i) For type 2 system, what will be the magnitude and phase angle of the term $(j\omega)^2$ in the denominator, at $\omega = 0$.

j) Find out the value of the variable X_6 from the following SFG (signal flow graph).

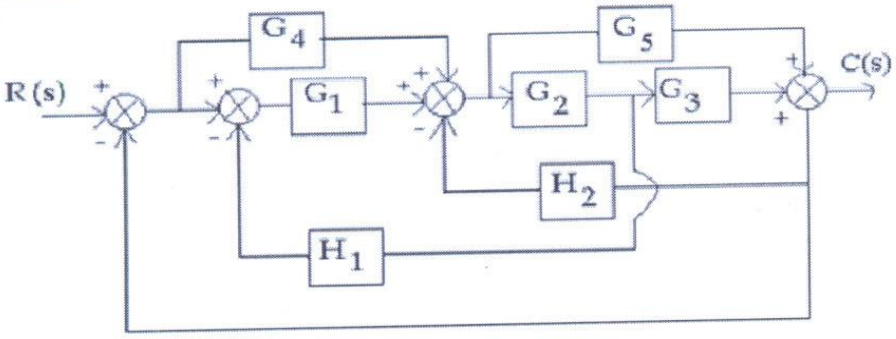


Q2 a) The block diagram of a system is given in the following figure. Find out the transfer function of the given system. Find out the poles and zeros of the system **(5)**



b) Describe a two phase a.c. servomotor and derive its transfer function. **(5)**

Q3 a) Determine the transfer function for the block diagram shown in the following figure by first drawing its signal flow graph and then using the Mason's gain formula. **(6)**



b) Describe the constructional and functional features of a stepper motor. **(5)**

Q4 a) The open loop transfer function of an unit feedback system is given as follows. **(6)**

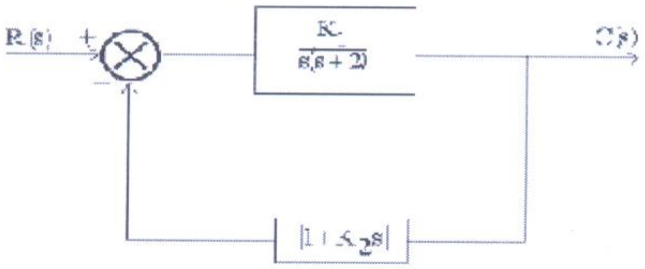
$$\frac{C(s)}{R(s)} = \frac{5}{s^2(s+2)(s+5)}$$

Determine the position error constant, velocity error constant, acceleration

error constant and the steady state error of the system when the system is separately connected with the inputs in the form of unit step function and ramp function.

b) Describe Routh-Hurwitz stability criterion. **(4)**

Q5 **a)** A system is given in the following block diagram. **(5)**



Determine the values of K_1 & K_2 such that the maximum overshoot with an unit step input will be 0.25 and peak time will be 0.8 seconds. Also obtain the rise time and settling time of the system.

b) Describe the rules for construction of root locus. **(5)**

Q6 **a)** Consider a unity feedback control system with the following open-loop transfer function. **(5)**

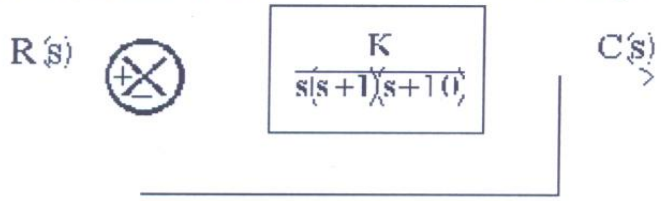
$$G(s) = \frac{K}{s(s^2 + s + 4)}$$

Determine the value of the gain K such that the phase margin is 50^0. What is the gain margin for this case?

b) The state model of a control system is given as follows. Compute the Eigen values and Eigen vectors of the following state model. **(5)**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Q7 Consider the system shown in the following figure. Draw the Bode-diagram of the open-loop transfer function G(s) with K = 1. Determine the phase margin and gain margin. Find the value of K to reduce the phase margin by 10^0. **(10)**



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

a) Relative stability by shifting the origin in s-plane

b) Cauchy's theorem

c) Effect of negative feedback on sensitivity