Registration No :

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

PET5I101

5th Semester Regular / Back Examination 2018-19

CONTROL SYSTEMS

BRANCH : ECE, ETC

Time : 3 Hours

Max Marks : 100

Q.CODE : E499

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 Short Answer Type Questions (Answer All-10) **(2 x 10)**

a) Differentiate between the open-loop and closed-loop system in response to bandwidth and sensitivity.

b) Write down the analogy terms in Force-voltage for translational system.

c) What do you mean by impulse response of a system? Why is it required in control systems?

d) Explain the effect of adding a zero to a 2nd order under-damped system.

e) Write at least two limitations of each of the Routh's stability and Hurwitz's stability criterion.

f) The closed loop transfer function is given by $T(s)=\dfrac{s+6}{Ks^2+s+6}$. Find the DC gain K for the damping ratio of 0.5

g) What is the drawback polar plot that Nyquist plot overcome. Define the principle of argument.

h) Why auxiliary equation is required in Routh array table?

i) What do you mean by transportation lag in control systems?

j) Define the procedure of Zeigler-Nichlos second method of tuning for PID controllers.

Part- II

Q2 Focused-Short Answer Type Questions- (Answer Any EIGHT out of TWELVE) **(6 x 8)**

a) Check the stability using Routh Array for the polynomial,

$$s^5+2s^4+s^3+2s^2+-2s-4=0$$

b) Considering the characteristic equation $s^3+9s^2+26s+K=0$, find the value K required so that the dominant time constant is equal to 0.5.

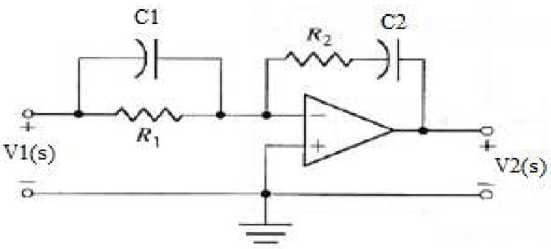
c) Find the mathematical modeling of armature controlled DC servo motor and justify armature controlled. Is this method is better to handle than flux control? Justify.

d) Assuming the desired considerations, find the transfer function for the water heating system.

e) The negative feedback system is less sensitive to feed forward path gain G variation w.r.t. open loop system and more sensitive to variation in feedback gain H in control system. Justify the statement.

f) The unit step response of a 2nd order under-damped system with unit dc gain is given by $c(t)=1-1.67e^{-4t}\sin(3t+36.87^0)$. Estimate the transient response specifications and its transfer function. Assume 2% tolerance.

g) Find the transfer function $\frac{V_2(s)}{V_1(s)}$ assuming an ideal OPAMP. Given $R_1 = 100K\Omega$, $R_2 = 200K\Omega$, $C_1 = 1\mu F$, $C_1 = 0.1\mu F$.



h) Justify, the derivative control improves damping, reduces peak overshoot and settling time.

i) A unit feedback system $G(s) = \frac{200}{s(s+8)}$ and r(t)=2t. Determine steady state error if it is desired to reduce the existing error by 5%. Find the new value of the gain of the system.

j) Define minimum phase, non-minimum phase and all pass system with phase plot.

k) Write down the properties of constant M-circles and constant N-circles.

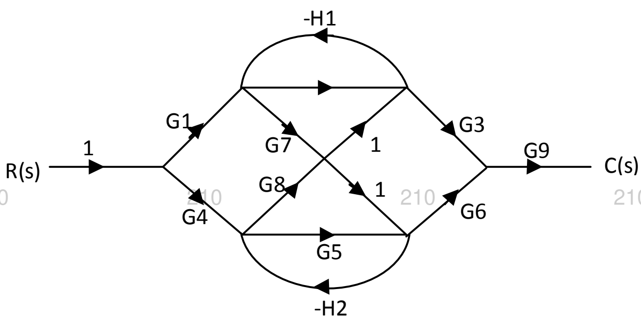
l) Justify the statement that the zeros of the characteristic equation is equal to the poles of the closed loop transfer function.

Part-III

Long Answer Type Questions (Answer Any TWO out of FOUR)

Q3 Differentiate between the signal flow graph (SFG) and block diagram reduction techniques. Enumerate the different rules adopted in block diagram reduction technique. **(16)**

Determine the transfer function C(s)/R(s) using SFG.



Q4 What is the drawback in static error coefficient method for finding steady state errors that can be overcome through generalized error coefficient method. Find the steady state errors in type "0", type "1" and type "2" for unit step, unit ramp and unit parabolic input respectively. **(16)**

A unit step input is applied to a unity feedback control system whose open loop transfer function is given by

$G(s)H(s) = \frac{K}{s(sT+1)}$. Determine the values of K and T given that maximum overshoot $M_P = 26\%$ and resonant frequency w_r =8 rad/sec. Calculate the resonant peak M_r, gain crossover frequency and phase margin.

Q5 Define phase margin, gain margin, phase crossover frequency and gain crossover frequency and locate on Bode plot. Comment on stability. **(16)**

Construct the Bode plot for the following given open loop transfer function $G(s)\,H(s) = \frac{Ks}{(s+1)^2(2s+1)}$. Find the value of K for a phase margin of 40^0.

Q6 Why root-locus plot is required?. What are the Evan conditions for this? Discuss the different construction rules for plotting root locus. **(16)**

Investigate the stability of the feedback system using Nyquist criterion for the following open-loop transfer function.

$$G(s)\,H(s) = \frac{K(s-1)}{s(s+2)}$$