Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 40959

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fourth Semester

Electronics and Communication Engineering

EC 6405 – CONTROL SYSTEM ENGINEERING

(Common to : Mechatronics Engineering/Medical Electronics)

(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

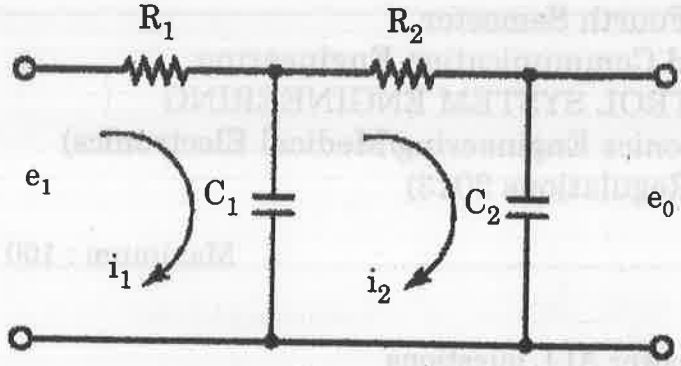
Answer ALL questions

PART – A (10×2=20 Marks)

1. What is called feedback control system ? Give an example.
2. Write the analogous electrical elements in torque-voltage analogy for the elements of mechanical rotational system.
3. Draw the unit-step response curve for the second order system and show the time domain specifications.
4. What are the dynamic error coefficients ?
5. Define gain margin and phase margin.
6. Why compensation is necessary in feedback control systems ?
7. What will be stability of the system when the roots of characteristic equation are lying on imaginary axis ?
8. How stability of linear control systems analyzed by using the Nyquist stability criterion ?
9. How do you define State and State vector ?
10. State Shannon's sampling theorem.

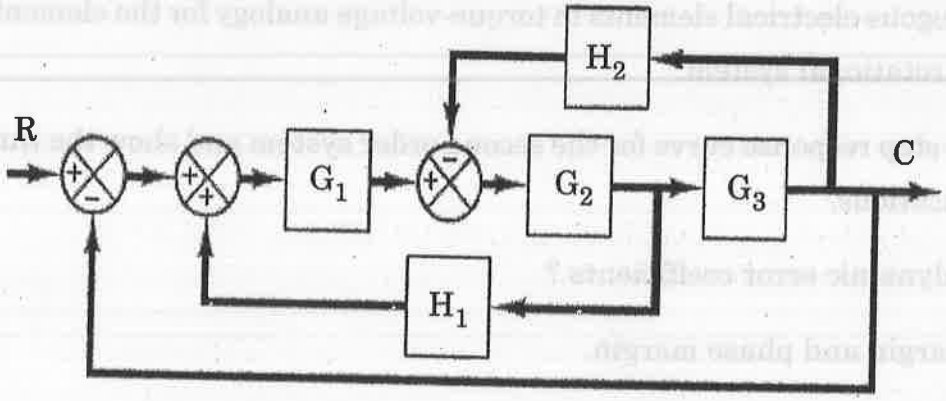
PART – B (5×13=65 Marks)

11. a) Write the differential equations governing the electrical system as shown in figure and determine the transfer function $\frac{E_o(s)}{E_i(s)}$. Assume the capacitances C1 and C2 are not charged initially. (13)



(OR)

b) Using block diagram reduction rules, obtain the closed loop transfer function of the system C(S)/R(S). (13)



12. a) A unity feedback control system has an open loop transfer function $G(s) = \frac{10}{s(s+2)}$ Determine its closed loop transfer function, damping ratio and natural frequency of oscillations. Also evaluate the rise time, peak overshoot, peak time and settling time for a step input of 12 units. (13)

(OR)

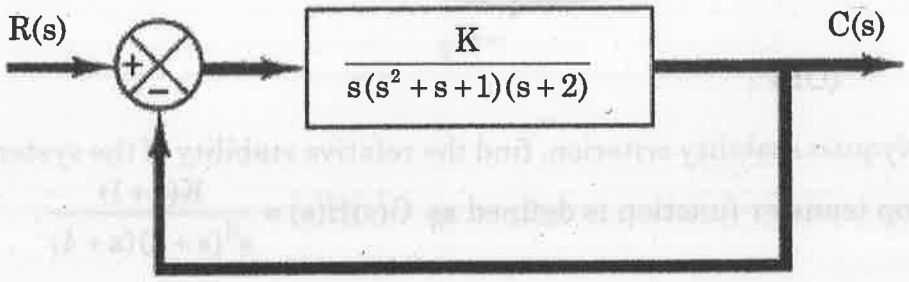
b) State and explain the effects of P, PI and PID controllers on the system dynamics. (13)

13. a) Discuss the procedure for constructing the bode magnitude plot and bode phase plot. **(13)**

(OR)

b) A unity feedback system has an open loop transfer function, G(s) = k/s(1+2s). Design a suitable lag compensator so that phase margin is 40° and the steady state error for ramp input is less than or equal to 0.2. **(13)**

14. a) Determine the range of K for stability for the system as shown in figure. **(13)**



(OR)

b) Sketch the root-locus plot for the system whose loop transfer function is $G(s) = \frac{K}{s(s+1)(s+2)}$, $H(s) = 1$ Determine the value of K such that the damping ratio of a pair of dominant complex-conjugate closed-loop poles is 0.5. **(13)**

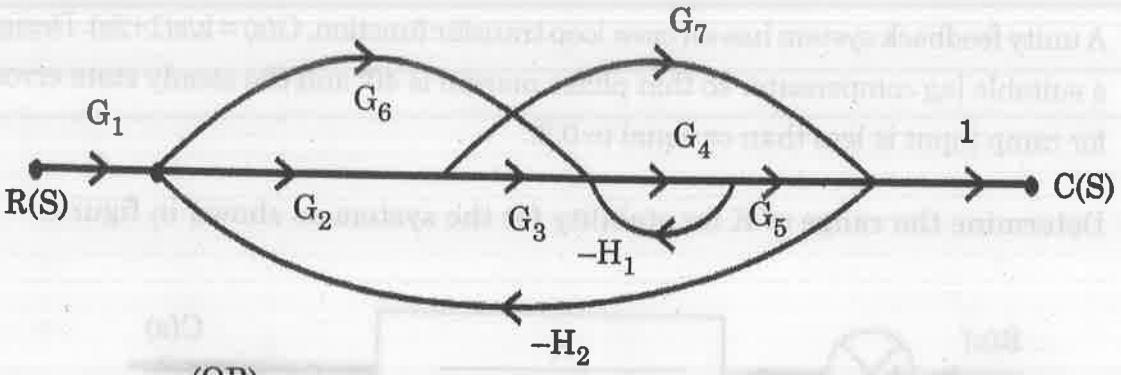
15. a) Obtain a state-space equation and output equation for the system defined by $\frac{Y(s)}{U(s)} = \frac{2s^3 + s^2 + s + 2}{s^3 + 4s^2 + 5s + 2}$. **(13)**

(OR)

b) What are sampled data control systems ? With an aid of a block diagram show basic elements of a sampled data control system and give functioning of these elements. **(13)**

PART – C (1×15=15 Marks)

16. a) Using Manson's gain formula, obtain the transfer function of the given signal flow graph.



(OR)

b) Using Nyquist stability criterion, find the relative stability of the system whose open loop transfer function is defined as $G(s)H(s) = \frac{K(s+1)}{s^2(s+2)(s+4)}$.