Roll No.:								

B.E. / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2011

ELECTRONICS & COMMUNICATION ENGINEERING BRANCH

FOURTH SEMESTER

EC 285 – CONTROL SYSTEMS

(REGULATIONS 2004)

Time: 3 hr Max. Marks: 100

Answer ALL Questions

PART-A (10 X 2 = 20 Marks)

1. Compare open loop and closed loop system.
2. State weather transfer function is applicable to nonlinear system.
3. Define rise time.
4. What are generalized error coefficients?
5. Define gain margin and phase margin.
6. Draw the frequency response of lag compensator.
7. State Nyquist stability criteria.
8. What are the difficulties encountered in applying Routh stability criterion?
9. What is meant by observability of a system?
10. Draw a typical block diagram of a sampled data control system.

PART-B (5 X 16 = 80 Marks)

11(a)(i). Obtain the transfer function of the mechanical systems shown in Fig. 11a(i). (8)

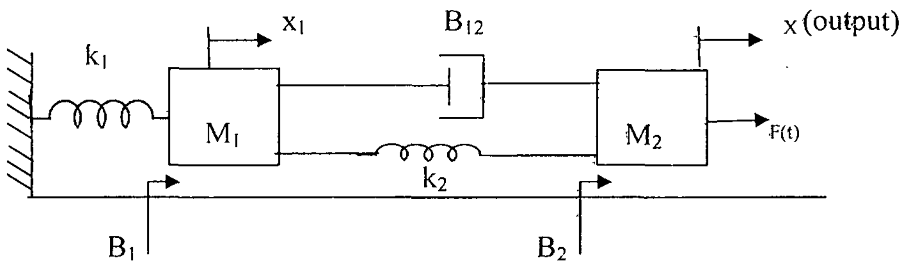

Fig. 11a(i)

(ii). Draw a signal flow graph for the system shown in Fig. 11a(ii) and hence obtain the transfer function using Mason's gain formula. (8)

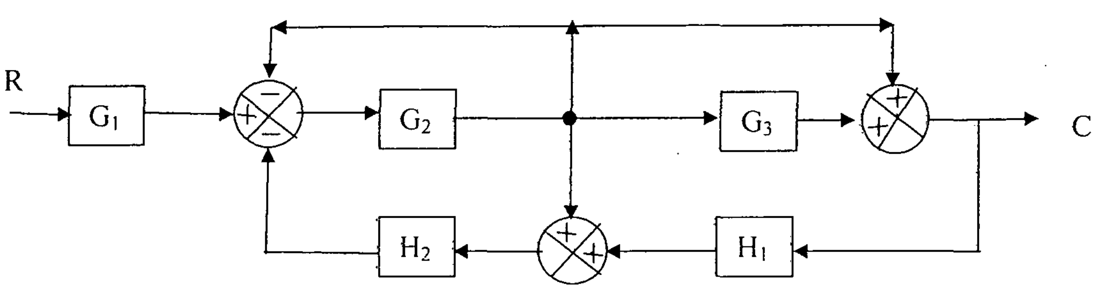

Fig. 11a(ii)

12(a)(i). Derive the expression for impulse response of second-order over damped system. (8)

(ii). Find the impulse response of the second order system whose transfer function $G(s) = 9 / (s^2 + 4s + 9)$ (8)

(Or)

(b)(i). A unity feedback system is characterized by an open loop transfer function $G(s) = K / (s (s + 10))$. Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K determine settling time, peak over shoot and time to peak over shoot for a unit step input. (8)

(ii). An unity feedback system is given as $G(s) = 1 / (s (s + 1))$. The input to the system is described by $r(t) = 4 + 6t + 2t^3$. Find the generalized error coefficients and the steady state error. (8)

13(a). Sketch the Bodeplot showing the magnitude in dB and phase angle in degrees as a function of log frequency for the transfer function given by $G(s) = 10/ (s (1 + 0.5s) (1+ 0.1 s))$ and hence determine the gain margin and the phase margin of the system. (16)

(Or)

(b). The open loop transfer function of the uncompensated system is $G(s) = 5 / (s (s + 2))$. Design a suitable lag compensator for the system so that the static velocity error constant k_v is 20 sec^{-1}, the phase margin is at least 55° and the gain margin is at least 12 dB. (16)

14(a). Sketch the root locus for a unity feedback system with open loop transfer function $G(s) = k / (s (s^2 + 8 s + 32))$. (16)

(Or)

(b). Using Routh-Hurwitz criterion for the unity feedback system with open loop transfer function $G(s) = k / (s (s + 1) (s + 2) (s + 5))$ find

(i) the range of k for stability (8)

(ii) the value of k for marginally stable (2)

(iii) the actual location of the closed loop poles when the system is marginally stable. (6)

15(a). Find the state equation for the system shown in Fig. 15a. (16)

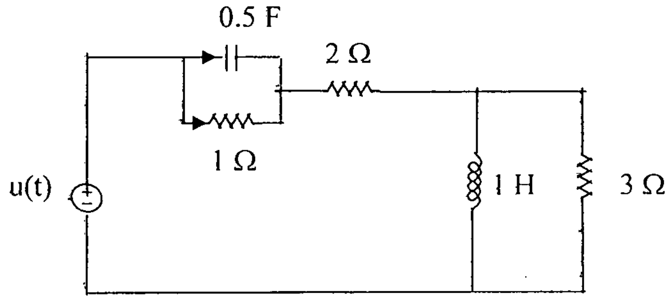

Fig. 15a

(Or)

(b)(i). A system is described by

$$\dot{X} = \begin{pmatrix} 1 & -1 \\ 1 & -1 \end{pmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U$$

$$Y = [\,1 \quad 0\,]\, X$$

Check the controllability and observability of the system. (8)

(ii). Obtain the state space representation of armature controlled dc motor. (8)