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Question Paper Code : 30945

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Electronics and Communication Engineering

EC 2255 — CONTROL SYSTEMS

(Regulation 2008)

(Common to PTEC 2255 — Control Systems for B.E. (Part-Time) Fourth Semester – ECE – Regulation 2009)

Time : Three hours Maximum : 100 marks

(Bode plot, Graph sheet, Semi-log, Nichol's chart are permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Transfer function.

2. Define resistance and capacitance of liquid level system.

3. How do you find the type of a system?

4. Find the unit impulse response of system $H(s) = 5/(s+4)$ with zero initial conditions.

5. Define State space.

6. What is meant by sample and hold?

7. Write the necessary and sufficient condition for stability in Routh stability criterion.

8. State Nyquist stability criterion.

9. Define observability.

10. Write down the sampling theorem.

PART B — (5 × 16 = 80 marks)

11. (a) Derive the transfer function of a RLC series circuit.

Or

(b) With a neat diagram, derive the transfer function of a field controlled dc motor.

12. (a) Determine the transfer function $\frac{y_2(s)}{F(s)}$ of the system shown in figure 12(a).

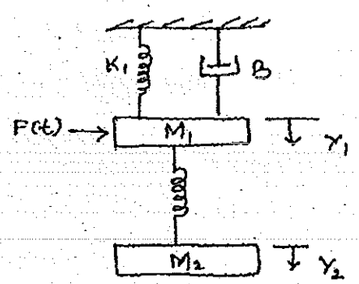

Figure 12(a)

Or

(b) A unity feedback system is characterized by the open loop transfer function $G(s) = \frac{1}{s(0.5s+1)(0.2s+1)}$. Determine the steady state errors for unit-step, unit-ramp and unit-acceleration unit. Also determine the damping ratio and natural frequency of the dominant roots.

13. (a) (i) List any four frequency domain specifications. (4)

(ii) Draw the bode magnitude and phase plot for the unity feedback system with $G(s) = \frac{40}{s(1+0.1s)}$ and hence determine phase margin and gain margin. (6 + 6)

Or

(b) A unity feedback, type-2 system has a open loop transfer function, $G(s) = k/s^2$. Design a lead compensator to meet the following specifications :

(i) Settling time, $t_s \leq 4s$.

(ii) Peak overshoot for step input ≤ 20%. (16)

14. (a) (i) Determine the range of k for stability of unity feedback system whose open loop transfer function is $G(s) = \frac{k}{s(s+1)(s+2)}$ using Routh stability criterion. (6)

(ii) Draw the approximate root locus diagram for a closed loop system whose loop transfer function is given by $G(s)H(s) = \frac{k}{s(s+5)(s+10)}$. Comment on the stability. (10)

Or

(b) Sketch the Nyquist plot for a system with open loop transfer function $G(s)H(s) = \frac{k(1+0.4s)(s+1)}{(1+8s)(s-1)}$ and determine the range of k for which the system is stable. (16)

15. (a) Consider a system with state-space model given below.

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 4 \end{bmatrix} u;\ y = [2 \quad -4 \quad 0]x + (0)u.$$

Verify that the system is observable and controllable.

Or

(b) Explain the functional modules of closed loop sampled data system and compare its performance with open loop sampled data system.