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

Question Paper Code : 53186

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

Fifth Semester

Instrumentation and Control Engineering

IC 6501 — CONTROL SYSTEMS

(Common to Electrical and Electronics Engineering/Electronics and Instrumentation Engineering/Instrumentation and Control Engineering)

(Regulation 2013)

(Also Common to PTIC 6501 — Control System for B.E. (Part-Time) for Third Semester — Instrumentation and Control Engineering – Regulations – 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention the characteristics of negative feedback.

2. Give the expression for masons gain formula.

3. Identify the order and type for system having $G(s) = 1/s^3(s+1)$.

4. What is damping ratio?

5. Differentiate between phase and gain cross over frequency.

6. Outline the correlation between time and frequency response.

7. Define Nyquist stability criterion.

8. What is compensation?

9. Identify the elements involved to construct the state diagram.

10. Show the advantages of state space modeling.

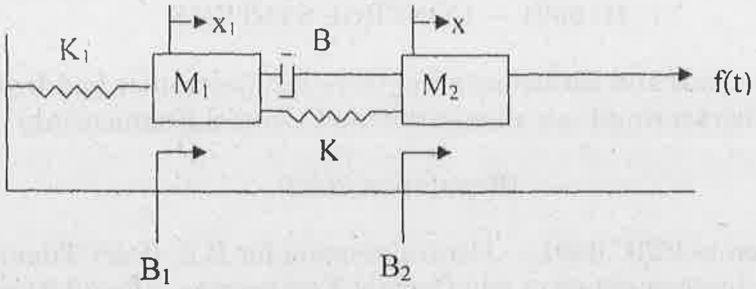
PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain in detail about the various elements of closed loop control system with an example. (10)

(ii) Give the reduction of serial and parallel blocks in block diagram representation of a system. (3)

Or

(b) Write the differential equations governing the mechanical system shown in below and determine the transfer function (13)



12. (a) (i) Derive the response of undamped second order system with unit step input (8)

(ii) Illustrate the time domain representation of various test inputs. (5)

Or

(b) A unity feedback control system has an open loop transfer function $G(s) = \frac{K(s+9)}{s(s^2+4s+11)}$. Sketch the Root Locus. (13)

13. (a) Give the bode diagram for the following transfer function and obtain the system gain K for the gain cross over frequency 5 rad/sec. (13)

$$G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}.$$

Or

(b) The open loop transfer function of a unity feedback system is given by $G(s)=\frac{1}{s(1+s)(1+2s)}$. Given the polar plot and determine the gain margin and phase margin. (13)

14. (a) Specify the stability of the system whose characteristics equation is given by $s^7 + 9s^6 + 24s^5 + 24s^3 + 24s^2 + 23s + 15 = 0$. (13)

Or

(b) Consider the unity feedback system whose open loop transfer function is $G(s) = \frac{K}{s(s+1)(s+5)}$. Design a lead compensator to meet the following specifications. (i) Velocity error constant, $Kv \geq 80$. (ii) Phase margin is ≥ 20 degrees. (13)

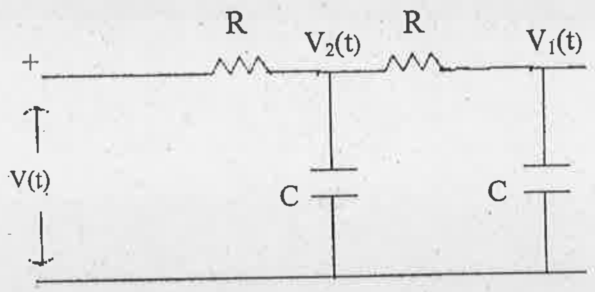
15. (a) (i) Estimate the state model for a system whose transfer function is given below. (8)

$$\frac{Y(s)}{U(s)} = \frac{10}{s^3 + 4s^2 + 2s + 1}.$$

(ii) Identify the concepts of controllability and observability. (5)

Or

(b) Estimate the state model of the electrical network shown in below. (13)



PART C — (1 × 15 = 15 marks)

16. (a) A unity feedback control system is characterized by the following open lop transfer function $G(s) = \frac{0.4s + 1}{s(s + 0.6)}$. Determine c(t) for unit step input. Evaluate the maximum overshoot and the corresponding peak time. (15)

Or

(b) Generate the Nyquist plot for the system whose open loop transfer function is $G(S)\,H(S) = \frac{K}{s(s+2)(s+10)}$. Determine the range of K for which closed loop system is stable. (15)