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

Question Paper Code : 21397

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

17.5.13 - FN

Fourth Semester

Electrical and Electronics Engineering

EE 2253/EE 44/EE 1253 A/10133 IC 401/080280033 – CONTROL SYSTEMS

(Common to Instrumentation and Control Engineering, and Electronics and Instrumentation Engineering)

(Regulation 2008/2010)

(Common to PTEE 2253 Control Systems for B.E. (Part-Time) Third Semester Electronics Instrumentation Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

(Graph sheet, semi log sheet and polar sheet may be permitted)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Compare closed and open loop system.

2. State the basic elements for modeling in translational and rotational systems.

3. Find the acceleration error coefficient for $G(s) = [K(1+s)(1+2s)] / [s^2(s^2+4s+20)]$.

4. State the effect of PI and PD controller on system performance.

5. Draw the polar plot for $G(s) = 10/[s^2(1+s)(s+2)]$.

6. State phase and gain margin.

7. State the necessary and sufficient condition for stability.

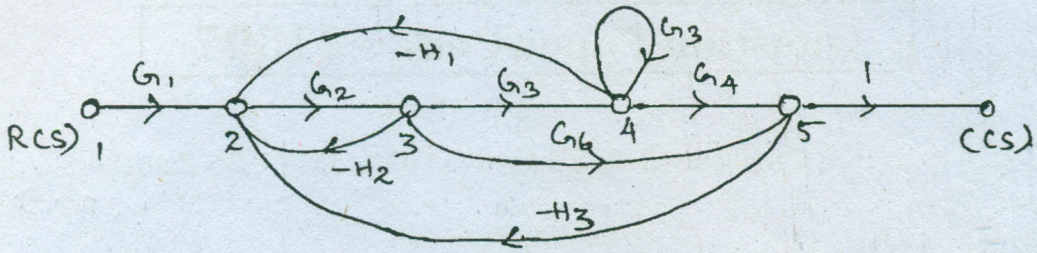
8. State Nyquist stability criterion.

9. Define compensator and list the types of compensators?

10. Write the transfer function of lag compensator and draw its pole zero plot.

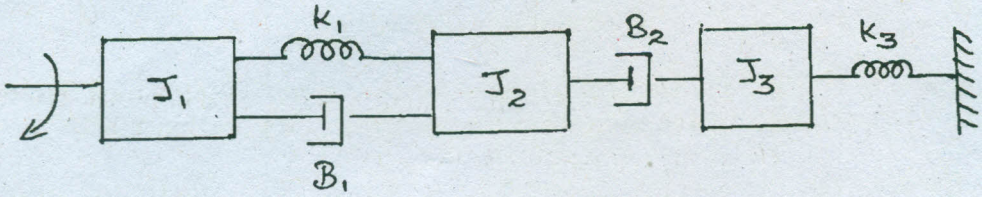
PART B — (5 × 16 = 80 marks)

11. (a) Find the overall gain for the signal flow graph shown.

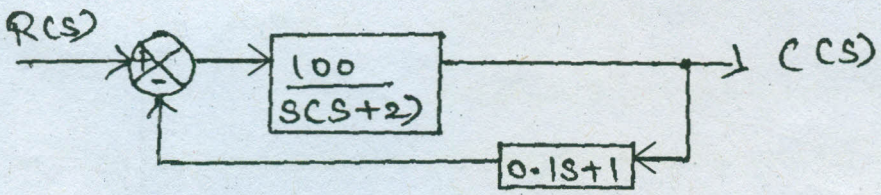


Or

(b) Write the differential equation governing the mechanical rotational system shown and draw the torque- voltage and torque-current electrical analogous circuits and verify by writing mesh equations.



12. (a) A positional control system with velocity feedback is shown. Determine the response of the system for unit step input.



Or

(b) Explain the effect by adding P, PI, PD and PID controllers in feedback control systems.

13. (a) Sketch the bode plot for the following transfer function and determine the value of K for the gain cross over frequency of 5 rad/sec $G(s)=Ks^2/[(1+0.2s)(1+0.02s)]$.

Or

(b) Sketch the polar plot for the following transfer function and determine the gain and phase margin. $G(s)=1/[s(1+s)(1+2s)]$.

14. (a) Construct Routh array and determine the stability of the system represented by the characteristic equation and comment on the location of roots.

(i) $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$

(ii) $s^7 + 5s^6 + 9s^5 + 9s^4 + 4s^3 + 20s^2 + 36s + 36 = 0$.

Or

(b) Sketch the root locus of the system whose open loop transfer function is $G(s) = K/[s(s+2)(s+4)]$. Find the value of K so that the damping ratio is 0.5.

15. (a) Design a lead compensator for a unity feedback system with open loop transfer function, $G(s) = K/[s(1+s)(s+5)]$ to satisfy the following specifications

(i) $k_v \geq 50$

(ii) phase margin is $\geq 20^\circ$.

Or

(b) (i) Describe the procedure for designing of a lag compensator.

(ii) Describe the design procedure of lag-lead compensator.

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