T 8194

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

Fourth Semester

Computer Science and Engineering

EE 1291 — ELECTRICAL ENGINEERING AND CONTROL SYSTEMS

(Regulation 2004)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   State Kirchoff's laws.

2.   Define power factor in terms of power components and load parameters.

3.   Mention the reasons for not developing emf in shunt generator.

4.   Define rotational voltage in induction motor.

5.   Give two applications of stepper motor.

6.   State any two rules of block diagram algebra .

7.   What are error constants?

8.   State the conditions for the function to be Hurwitz.

9.   How will you assess the stability of a system using Nyquist criterion.

10. State the advantages of pneumatic systems over hydraulic systems.

PART B — (5 × 16 = 80 marks)

11. (a)   (i)   Use loop current analysis to find the currents in each battery in the network of Fig. Q. 11 a(i)   (8)
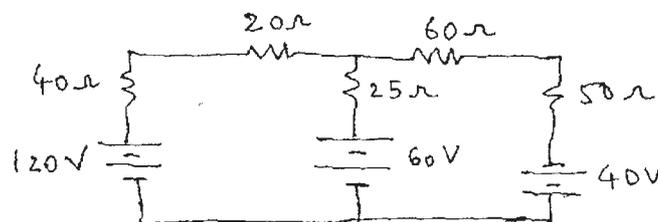

Fig. Q. 11 a(i)

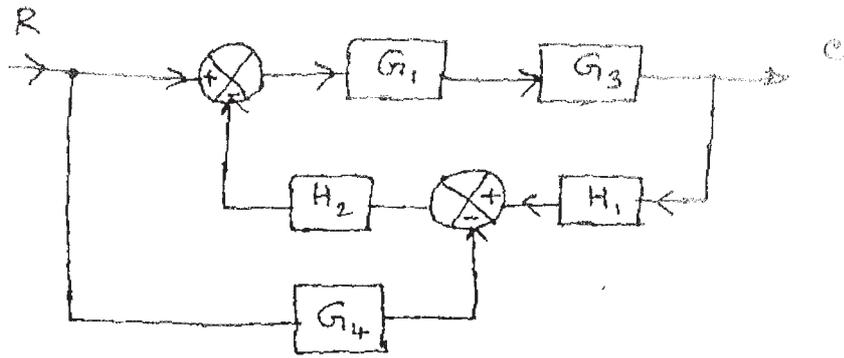(ii) Determine the closed loop transfer function of a system whose block diagram is given in Fig. Q. 12 (a) (ii). (8)

Fig. Q. 11 (a) (ii)

Or

(b) (i) Solve example in Fig. Q 11 a(i) using node voltage analysis. (8)

(ii) With suitable example, derive the Mason's gain formula. (8)

12. (a) (i) Find the average value, rms value and form factor of a periodic wave having the following values for equal time intervals suddenly from one value to the next : 0, 5, 10, 20, 50, 60, 50, 20, 10, 5, 0, –5, –10 V etc. (8)

(ii) A unity feed back systems has $G(s) = \dfrac{1}{s(1+s)}$. The input to the system is described by $r(t) = 4 + 6t + 2t^3$. Find the generalised error coefficients and the steady state error. (8)

Or

(b) (i) Two impedances $(8 + j10)$ ohm and $(7 + j9)$ ohm are connected in parallel. Find the magnitude and phase angle of total impedance. Another impedance $(5 - j2)$ ohm is connected in series with above combination. Find the overall impedance. (8)

(ii) A servomechanism has its moment of inertia $10 \times 10^{-6}\,\text{kg} - \text{m}^2$, retarding friction 400×10^{-6} N–m/rad/sec. The output torque is 0.004 N–m/rad error. Find the natural frequency and damping factor of the system. (8)

13. (a) (i) Derive the emf equation of a D.C generator. (8)

(ii) A system has the characteristic equation.

$q(s) = s^5 + 2s^4 + 2s^3 + 4s^2 + 11s + 10$ Test the stability and find out the number of roots in the R.H.S of the Splane using Routh criterion. (8)

Or

(b) (i) Explain the principle of operation of D.C motor. (8)

(ii) Briefly explain the methods of assessing stability. (8)

14. (a) (i) Explain the constructional details of three phase induction motors.

(8)

(ii) How is the closed loop frequency response of the control system obtained from M and N circles? (8)

Or

(b) (i) Explain the significance of the terms regulation, losses and efficiency of transformer. (8)

(ii) Explain the procedure to draw the polar plot and discuss how the stability of the system can be found from it. (8)

15. (a) (i) Explain why single phase induction motor is not self starting? (8)

(ii) Write a technical note on servomotors. (8)

Or

(b) (i) Explain the principle of operation of variable reluctance motor. (8)

(ii) Explain the constructional details and operation of stepper motor.

(8)