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

D 4174

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

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. Give the step by step procedure for solving circuit equations using mesh analysis.

2. Mention two important characteristics of series RLC circuit under resonance condition.

3. Draw the torque Vs armature current characteristics of d.c. shunt and d.c. series motor.

4. Give the advantages of 3 phase transformer compared to three units of single phase transformers.

5. Draw the circuit diagram of capacitor start induction run single phase induction motor.

6. Give the original block diagram and the corresponding equivalent block diagram for any two rules in block diagram algebra.

7. Define steady state error and % peak overshoot in the time response specifications.

8. State Routh-Hurwitz criterion for the system stability.

9. State Nyquist criterion for stability.

10. Mention the applications of stepper motor.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Use Node voltage analysis to find the currents in each battery in the network shown in Fig. Q. 11 (a) (i). (8)

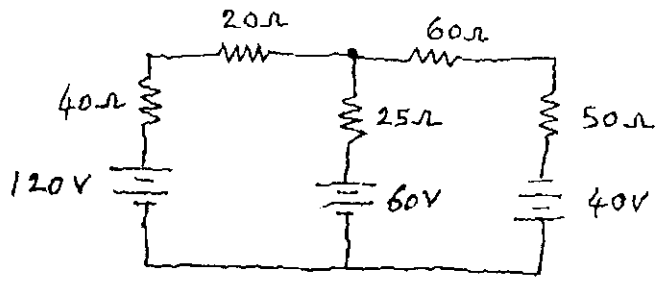

Fig. Q. 11 (a) (i).

(ii) Using Mason's gain formula, find the transfer function of the system whose signal flow graph is shown in Fig. Q. 11 (a) (ii). (8)

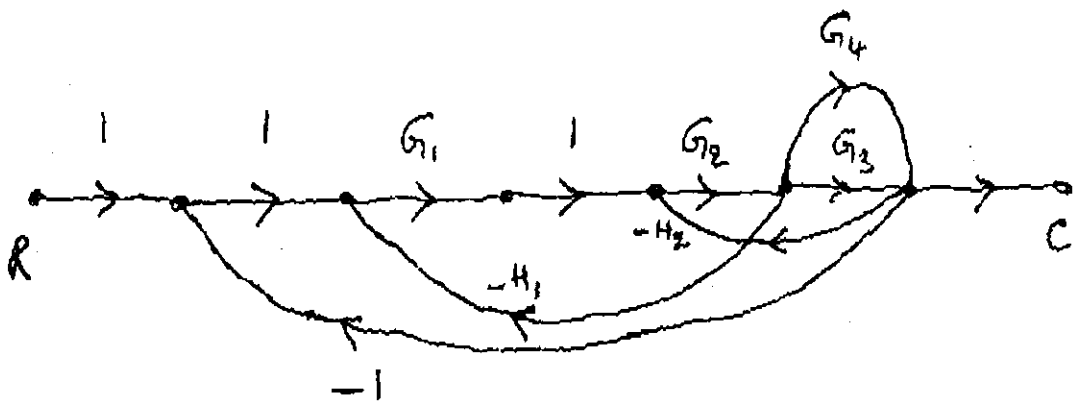

Fig. Q. 11 (a) (ii).

Or

(b) (i) Three loads A, B and C are connected in parallel to a 250 V source. Load A takes 50 A. Load B is a resistance of 10 Ω and Load C takes 6.25 kW. Calculate

(1) R_A and R_C

(2) the currents I_B ad I_C

(3) power in loads A and B

(4) total current

(5) total power. (8)

(ii) For a mechanical system shown in Fig. Q. 11 (b) (ii), obtain the differential equation. (8)

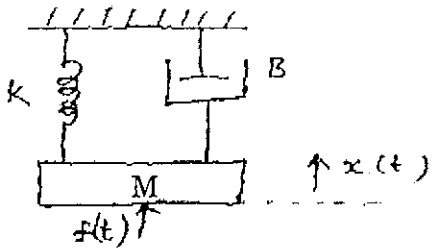

Fig. Q. 11 (b) (ii).

12. (a) (i) Show that the sum of two wattmeter readings gives the total three phase power in two wattmeter method. (8)

(ii) A servomechanism has its moment of Inertia 10×10^{-6} kg-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)

Or

(b) (i) Find the form factor and peak factor for the symmetrical voltage wave shown in Fig. Q. 12 (b) (i). (8)

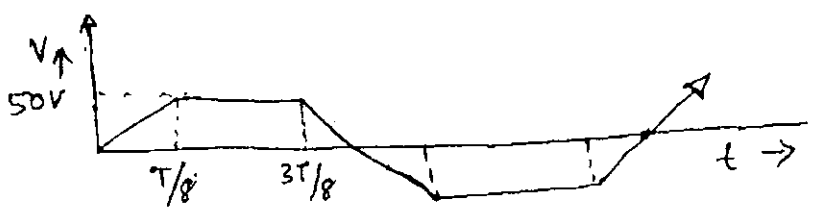

Fig. Q. 12 (b) (i).

(ii) An unity feedback system is given as

$$G(s) = \frac{1}{S(1+S)}$$

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)

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

(ii) Using Routh-Hurwitz criterion, test the stability of the system whose characteristic equation is

$$F(S) = S^6 + 2S^5 + 4S^4 + 4S^3 + 1S^2 + 4S + 6 = 0$$ (8)

Or

(b) (i) Draw and explain the O.C.C. and external characteristics of separately excited generator. (8)

(ii) Investigate the given F (S) for stability

$$F(S) = S^4 + KS^3 + (K+1)S^2 + (K+2)S + 2 = 0$$ (8)

14. (a) (i) Develop the equivalent circuit of transformer with secondary impedances transferred to primary. (8)

(ii) Using Nyquist stability criterion, test whether the system with $G(S)\ H(S) = \frac{(S+1)}{(S-2)}$ is stable. (8)

Or

(b) (i) Derive the rotor emf and current equations of three phase induction motor under running conditions. (8)

(ii) With suitable example, explain Bode plot. (8)

15. (a) (i) Explain the various starting methods of single phase induction motor. (8)

(ii) Develop the transfer function of field controlled D.C. motor. (8)

Or

(b) (i) Describe the constructional details and principle of operation of single phase induction motor. (8)

(ii) Explain A.C. servo motor for servo applications. (8)
