D 085

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2003.

Third Semester

Computer Science and Engineering

EE 255 — ELECTRICAL ENGINEERING AND CONTROL SYSTEMS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State superposition theorem.

2. Give the algorithm for solving Loop Current Analysis.

3. Draw the equivalent circuit of a single phase transformer and name the components.

4. Draw Torque Versus armature current characteristics of D.C. shunt and series motors.

5. Explain briefly why single phase induction motor is not self starting.

6. Draw the circuit diagram of three phase rectifier using SCRs.

7. Show that the transfer function of canonical form of general block diagram with negative feed back is given by

$$G(s)/(1+G(s)\cdot H(s))$$

8. State Mason's rule.

9. What is the need for state variable approach?

10. Give steady state error for step and velocity input.

PART B — (5 × 16 = 80 marks)

11. A 10 kVA, 200/400 V, 50 Hz, single phase transformer gave the following test results.

Open circuit test (*hV* winding open) 200 V, 1.3 A, 120 W

Short circuit test (*lv* winding short circuited) 22 V, 30 A, 200 W.

Calculate (i) magnetising current and the current corresponding to core loss at normal voltage and frequency (ii) parameters of equivalent circuit as referred to low voltage winding.

12. (a) For the circuit shown in Fig. 12 (a), find the currents through R_3 and R_4.

$E_a = 100$ V; $E_b = 40$ V; $R_1 = R_2 = R_5 = 10$ ohms

$R_3 = R_4 = 20$ ohms.

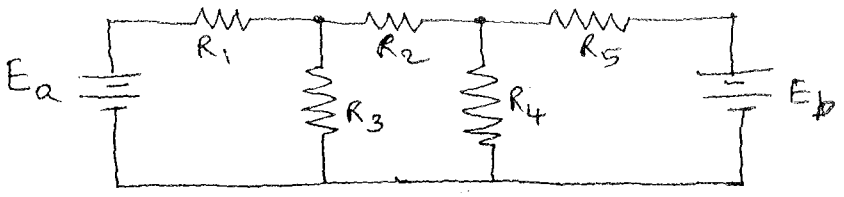

Fig. 12 (a)

Or

(b) Two similar coils are magnetically coupled and their coefficient of coupling is 0.3. When the two are cumulatively connected in series, the total inductance is 100 mH. Calculate (i) self inductance of each coil (ii) total inductance when the coils are connected in series opposing connection (iii) the energy in the magnetic field with a current of 3 A and the two coils connected in both series aiding and series opposing connections.

13. (a) (i) Derive the torque equation of a d.c. motor. (6)

(ii) A 220 V shunt motor with an armature resistance of 0.5 ohm is excited to give constant field. At full load, the speed is 500 RPM and armature current is 30 A. If a resistance of 1 ohm is connected in series with the armature find the speed at full load torque. (10)

Or

(b) Explain double field revolving theory applied to single phase induction motor and develop the equivalent circuit.

14. (a) (i) Explain the principle of operation of a shaded pole motor. (8)

(ii) Draw and explain the working of Mc–Murray inverter. (8)

Or

(b) (i) Briefly explain open loop, closed loop and automatic control system. (6)

(ii) Using Mason's rule, determine the transfer function of the signal flow graph shown in Fig. 14 (b). (10)

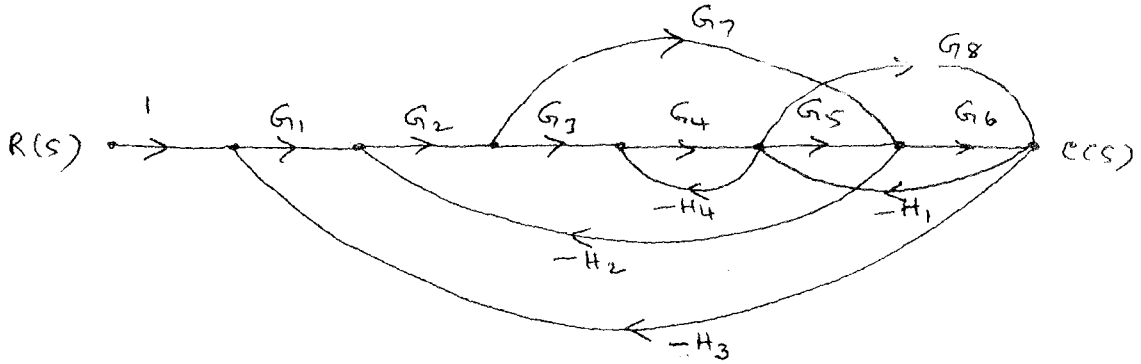

Fig. 14 (b)

15. (a) Obtain the state model of the electromechanical system shown in Fig. 15 (a).

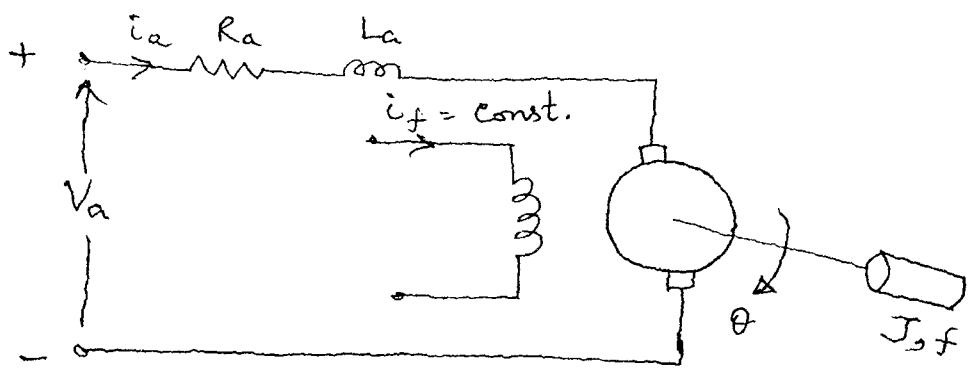

Fig. 15 (a)

Or

(b) (i) Explain time response specifications. (6)

(ii) A unity feed back system has the forward open loop transfer function $G(s) = \frac{10}{s+1}$. Find the steady state error and the generalised error coefficients for $r(t) = t$. (10)
