

**T 8186**

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

Third Semester

Mechatronics Engineering

EE 1215 — ELECTRICAL MACHINES AND DRIVES

(Regulation 2004)

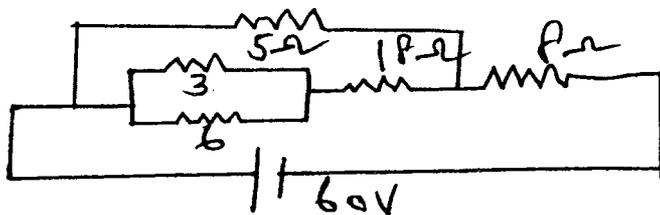
Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the condition for the maximum efficiency of transformer?
2. Find the effective resistances and the voltage drop across each resistor of the following circuit diagram.

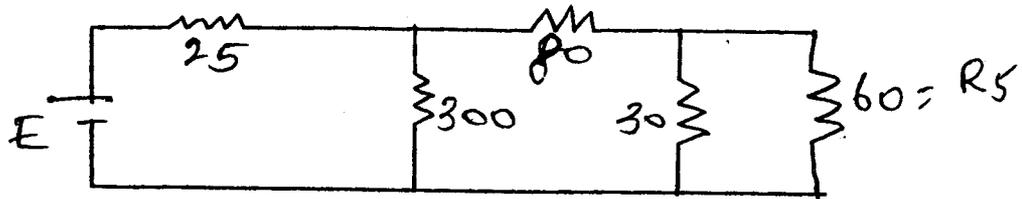


3. Calculate the emf generated by 4 pole, wave wound armature—having slots of 45 with 18 constructors per slot when driven at 1200 rpm. The flux per pole is 0.04 wb.
4. List out the various applications of Stepper motor.
5. What are the assumptions to be made in determining the variations of temperature rise in machines with time.
6. Which method is suitable to determine the capacity of synchronous motor for continues Duty variable load.
7. Mention the different types of electrical braking.

8. Mention the different types of starting methods for three-phase induction motor.
9. What are the advantages and disadvantages of Solid-state drives?
10. Define duty ratio.

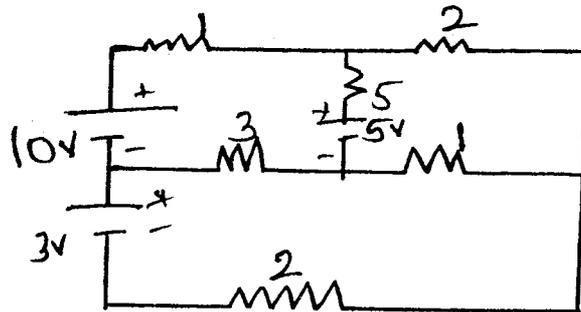
PART B — (5 × 16 = 80 marks)

11. (a) For the given circuit Find (i) the equivalent series circuit (ii) the value of E which would yield power dissipation in  $R_5$  of 15 watts.



Or

- (b) (i) Derive the equation emf equation of the single phase transformer.
- (ii) Find the current in all branches of the given circuit by mesh current method.



12. (a) (i) Explain in detail about the various parts of DC machine.
- (ii) Explain the double field revolving theory.

Or

- (b) Explain the mechanical and electrical characteristics of DC shunt motor.
13. (a) A 3 phase, 6 pole, 50 Hz, 4000 V, star connected synchronous motor has a resistance and synchronous impedance of  $0.5 \Omega$  and  $4 \Omega$  respectively. It takes a current of 15 A at unity power factor when operating with certain field current. If the load torque is increased until the line current is increased to 60A, the field current remaining unchanged, calculate the gross torque developed and the new power factor.

Or

(b) A 500 V, 45 kW, 600 rpm DC shunt motor has the full load efficiency of 90%. The field resistance is  $200 \Omega$  and the armature resistance is  $0.2 \Omega$ . The field current is maintained constant. Armature reaction and brush drop may be neglected. Calculate the rated armature current and hence, find the speed under each of the following conditions at which the machine develops an electromagnetic torque equal to the rated value

- (i) Regenerative braking : no external resistance
- (ii) Plugging : external resistance of  $5.5 \Omega$  inserted
- (iii) Dynamic braking : external resistance of  $2.6 \Omega$  inserted.

14. (a) (i) The temperature rise of an electric motor is  $40^\circ$  after 1 hour and  $60^\circ\text{C}$  after 2 hrs. the motor current is 100 A. Determine approximately its final temperature rise when it works on load cycle of 4 minutes working, 8 minutes rest with a current of 125 A. Neglect the effects of iron losses.
- (ii) Discuss the following : Insulating materials and power loss of electric motor.

Or

(b) Discuss the procedure of selection of motor for periodic intermittent duty.

15. (a) Explain how the DC motor could be controlled using 3 phase fully controlled bridge converter for  $\alpha = 0^\circ$ . Draw the necessary wave forms and circuit diagrams.

Or

(b) Explain in detail about the closed loop control of slip power recovery scheme for a wound round induction motor.