Code No. : 5348/N

FACULTY OF INFORMATICS

B. E. 2/4 (IT) I Semester (New) (Main) Examination, December 2011

ELECTRICAL CIRCUITS AND MACHINES

Time: 3 Hours] [Max. Marks: 75

Note: *Answer* ***all*** *questions from Part* ***A****. Answer* ***five*** *questions from Part* ***B****.*

PART – A **(25 Marks)**

1. What is the complex power of 1 kVA at 0.8 of lagging? **2**
2. An electrical load of 1kVA at 0.8 pf lagging is supplied from 220 V, 50 Hz supply. Calculate the capacitance of a shunt capacitor across the load to improve the overall power factor to unity. **3**
3. The terminal current of a 10 kΩ resistor is 5 mA. Find the conductance. **2**
4. State whether or not the following voltages form a balanced three -phase set **2**

   $V_a = 3983 \sin(\omega t + 50°)$ V

   $V_b = 3983 \cos(\omega t - 160°)$ V

   $V_c = 3983 \cos(\omega t + 70°)$ V
5. What are the two fundamental laws on which transformers operate ? **2**
6. Sketch speed versus torque characteristics of shunt and series motors. **3**
7. A three-phase 400 V, 50 Hz, 4 pole induction motor produces 10 hp at the shaft running at 1440 rpm. Determine the efficiency of the induction motor neglecting all losses except rotor copper loss. **3**
8. Sketch speed-torque characteristics of a capacitor-start and capacitor-run single-phase induction motor. **3**
9. What are different types of stepper motors ? **2**
10. Draw the equivalent circuit of an alternator showing leakage reactance, armature reaction reactance and armature resistance. **3**

PART – B (50 Marks)

11. a) State Kirchoff's current law. 3

b) Find i and V_{ab} in Fig. 1. 4

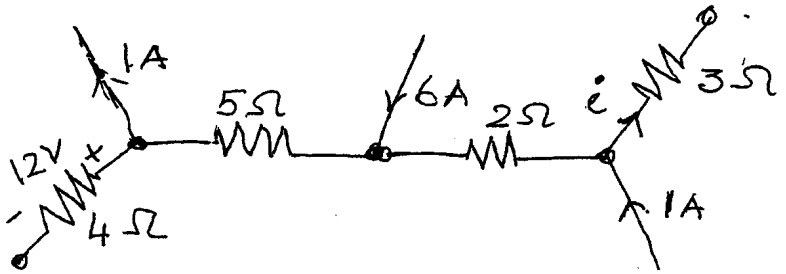

Fig. 1

c) Derive an expression for the energy stored in an inductor. 3

12. a) Derive an expression for the electromagnetic torque in a separately excited dc motor. 5

b) In a separately excited dc motor, assuming linear magnetic structure and ignoring losses, the field current is reduced to $I_f/2$ keeping the armature voltage (V) and current (I_a) the same. If the speed, power and torque under normal operating conditions are N, P, T respectively, determine the speed, power and torque under new operating conditions. 5

13. a) Derive the relationship between the line and phase voltages and currents in a balanced wye (star) - connected system. 4

b) A single-phase 250 kVA, 11kV/2.2 kV, 50 Hz, transformer has the following parameters. 6

Windings : $R_{HV} = 1.3\Omega$, $X_{HV} = 4.5\Omega$, $R_{LV} = 0.05\Omega$, $X_{LV} = 0.16\Omega$

Shunt branches : $R_{C(L.V.)} = 2.4\,k\Omega$, $X_{m\,(L.V.)} = 0.8k\Omega$.

i) Draw the approximate equivalent circuit referred to the LV side.

ii) Calculate approximate values of core loss and copper loss at rated voltage.

14. a) Explain the principle of operation of three-phase induction motor. 3

    b) A three-phase 460V, 60 Hz, induction motor produces 100 hp at the shaft at 1746 rpm. Determine the efficiency of the motor if rotational losses are 3500 W and stator copper losses are 3000 W. 7

15. a) Explain how you would determine synchronous impedance of an alternator. 6

    b) Explain regulation of an alternator. 4

16. a) Explain how a starting torque is produced in a single-phase induction motor. 5

    b) What are various types of single-phase induction motors ? 3

    c) What are various applications of single-phase induction motors ? 2

17. Write short notes on : 10

    a) Three-point starter

    b) Starting methods of three-phase induction motors.