Code No. : 5348/S

FACULTY OF INFORMATICS
B.E. 2/4 (Mech./Prod./I.T.) I Semester (Suppl.) Examination, July 2012
ELECTRICAL CIRCUITS AND MACHINES

Time : 3 Hours] [Max. Marks : 75

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

PART – A **(25 Marks)**

1. State Kirchhoff's voltage law. **2**

2. Find the phasor form of $v(t) = 5 \sin (100\,t - 40°)v$. **2**

3. State whether or not the following voltages form a balanced three-phase set. **2**
   $v_a = 170 \sin (\omega t + 30°)$ v
   $v_b = -170 \cos (\omega t)$ v
   $v_c = 170 \cos (\omega t + 60°)$ v

4. A transformer has 1000 primary turns and 100 secondary turns. The reluctance of the magnetic structure is $R = 10^5$ AT/wb. Assume no leakage flux, no iron losses and ignore wire resistance. If the primary voltage is 240 V, 50 Hz and the secondary is open circuited, how much current will flow in the primary ? **3**

5. Draw the output voltage versus output current of a dc shunt generator. Explain briefly. **3**

6. Draw torque versus speed characteristics of a three-phase induction motor and mark the possible operating speed of the motor. **3**

7. Show the open circuit and short circuit characteristics of an alternator. Comment on these characteristics. **3**

8. Why is a single-phase induction motor not self starting ? **3**

9. An open circuit test is performed on a transformer applying 240 V on the LV side passing 3.62 A and measuring input power of 290 W. The short circuit test is performed on the HV side applying 372 V passing 2A and measuring input power of 245 W. In the open circuit, the voltage measured on the HV side is 7500 V. What is the transformer apparent power rating ? **2**

10. Draw speed versus torque characteristics of a dc series motor. Comment on the characteristics pointing out its application. **2**

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PART – B (50 Marks)

11. a) Explain Thevenin's theorem. 5

b) Find i by applying Thevenin's theorem in Fig. 1. 5

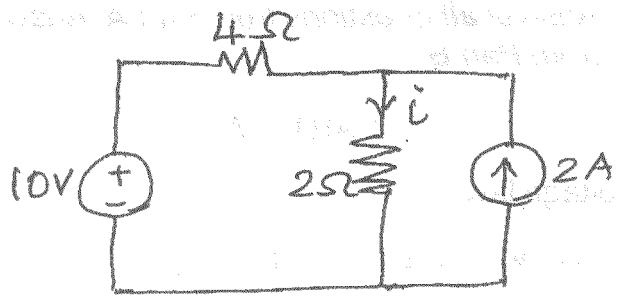

Fig. 1

12. a) Find the line currents I_{aA}, I_{bB}, I_{cC} in Fig. 2. 5

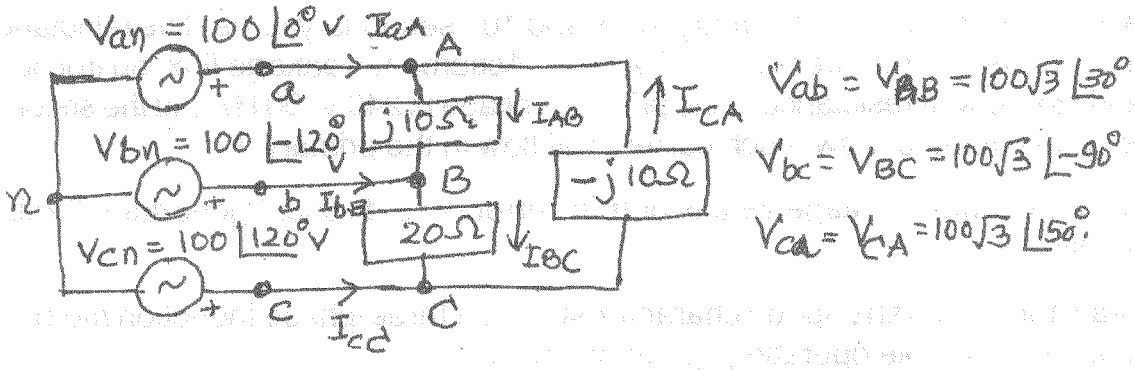

Fig. 2

b) Explain with necessary diagrams how three-phase power can be measured by two wattmeters. 5

13. a) Draw the exact equivalent circuit of a transformer showing all the parameters. clearly state, what tests are conducted to determine the parameters in the equivalent circuit. 5

b) What are various losses in a transformer ? 3

c) Define the efficiency of a transformer. 2

14. A three-phase Y-connected, 60 Hz induction motor has the following nameplate information. 2hp, 3450 rpm, 230 V (line voltage), 5.2 A.
    a) Determine the number of poles. 3
    b) At nameplate conditions, the stator copper, stator iron, rotor copper and mechanical losses divide in the ratios 4 : 2 : 3 : 1. Find the mechanical losses of the motor in watts. (Hint : use the relation, rotor copper losses = 3 × mechanical losses to obtain the mechanical losses) 5
    c) Determine the efficiency of the motor. 2

15. A belt-driven dc shunt generator runs at 1800 rpm delivering 20 kW at 250 V bus bars (supply). The belt breaks following which the machine acts as a motor drawing 5 kW power from the dc bus bars. The armature and field resistances are 0.2 Ω and 50 Ω respectively. Neglect brush contact drops and armature reaction.
    a) What is the e.m.f. of the generator ? 3
    b) What is the e.m.f. of the motor ? 3
    c) Calculate the speed at which the motor will run ? 4

16. a) What are different types of single-phase induction motors ? 4
    b) Explain in detail about capacitor start and capacitor-run single-phase induction motor. 6

17. Write short notes on : 10
    a) Stepper motors
    b) Three-point starter.
