(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2019 Roll No.

B.Tech.

(SEM II) EVEN SEMESTER THEORY EXAMINATION, 2009-2010

ELECTRICAL ENGINEERING

Time : 3 Hours *Total Marks : 100*

Note: *(i) Attempt **ALL** questions.*

*(ii) All questions carry **equal** marks.*

(iii) In case of numerical problems assume data wherever not provided.

(iv) Be precise in your answer.

1. Attempt **any four** parts of the following : **(4x5=20)**

(a) An alternating current is represented by $i = 400 \sin(157t + \pi/6)$ Determine :

(i) Average value of current

(ii) RMS value of current

(iii) Time period

(iv) Form Factor

(v) Phase angle

(b) With the help of power triangle explain active and reactive powers. Prove that in a purely inductive circuit power absorbed is zero.

(c) A series combination of R and C is in parallel with a 20Ω resistor across 50 Hz source results in a total current of 8A. Current through the 20Ω resistor is 5A and current in the R-C branch is 3A. Determine R and C.

(d) A voltage wave $e(t) = 141.4 \sin 120t$ produces a current

$i(t) = 14.14 \sin 120t + 7.07 \cos (120t + 30°)$ in a circuit.

Determine :

(i) the time expression of resultant current

(ii) the power factor of the system and the power delivered by the source.

(e) A series combination of a capacitor C and resistor R is shunted by an inductive coil having resistance R and inductance L and the combination is connected to an ac source. Show that the impedance of the circuit will be independent of frequency if $R = \sqrt{\frac{L}{C}}$.

(f) Deduce analogy on three points between magnetic circuit and electric circuit. What are the two major points of difference between them ?

2. Attempt **any four** parts of the following : (4x5=20)

(a) In the network shown in Fig. 1.1 determine the direction and magnitude of current flow in the ammeter A having a resistance of 10Ω.

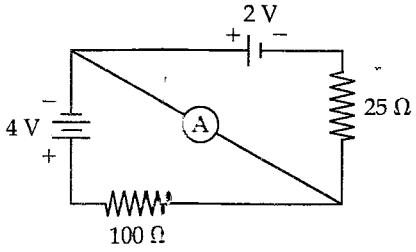

Fig. 1.1

(b) Determine Nortons's equivalent across AB in Fig.1.2.

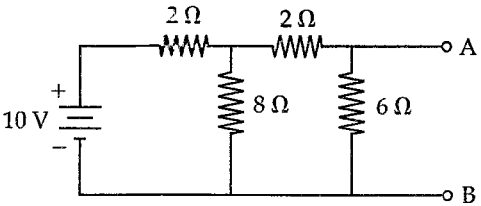

Fig. 1.2

(c) State and explain maximum power transfer theorem. Find the value of R which will absorb maximum power in Fig. 1.3.

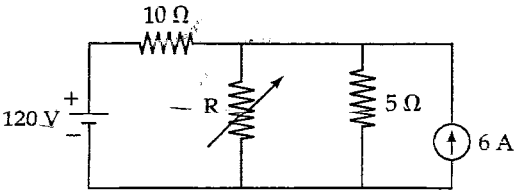

Fig. 1.3

(d) Deduce the expression for converting a star connected resistances into an equivalent delta.

(e) Describe the constructional details of a single phase induction types energy meter with the help of a circuit diagram. Give its principle operations and use.

(f) A moving coil instrument gives a full scale deflection of 10m A when the potential differences across its terminals is 100 mV. Calculate the series resistance to measure 1000V on full scale.

3. Attempt **any two** parts of the following : **(2x10=20)**

(a) Compare star and delta systems of connection in 3 phase a.c. circuits. Justify that total power in the 3-phase, 3-wire star connected load circuit is the algebric sum of two wattmeters. A 3-phase 400V motor load has a power factor of 0.75(lag). Two wattmeters connected to measure the power, reads the total input to be 26 kW. Find the reading of each instrument.

(b) Define voltage regulation of a single phase transformer. How it is determined ? Calculate the regulation of a transformer in which ohmic drop is 1% and reactance drop 5% of the voltage at the following power factors (i) 0.8 lagging (ii) 0.8 leading.

(c) Following are the test results for the 4 kVA, 200V/400V, 50Hz single phase transformer

OC test : 200V, 0.8A, 70 W

SC test : 17.5V, 9A, 50 W

Calculate the parameters of equivalent circuit and its efficiency at full load.

4. Attempt **any two** parts of the following : **(2x10 =20)**

(a) Explain the role of back emf in DC motor. A 200V dc series motor runs at 500 rpm when taking a current of 25A. The resistance of the armature is 0.5Ω and that of the field is 0.3Ω. If the current remains constant, calculate the resistance necessary to reduce the speed to 250 rpm.

(b) Draw and explain :

(i) Operating characteristics of D.C. shunt generator.

(ii) Speed-torque characteristic of D.C. motor.

(iii) V curve of Synchronous motor.

(c) Explain the methods of speed control of D.C. motors. Give the application of the D.C. series motor, D.C. shunt motor and synchronous motor.

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5. Attempt **any two** parts of the following : **(2x10=20)**

(a) Prove that for 3-phase Induction motor.

Pg : rotor ohmic loss : Pm = 1 : S : (1 − S).

Where Pg = Airgap power

Pm = Mechanical power

The power input to a 500 V, 50Hz, 6 pole, 3-phase squirrel cage induction motor running at 975 rpm is 40 kW. The stator losses are 1 kW and the friction and windage losses are 2 kW. Calculate (i) slip (ii) rotor copper loss (iii) motor efficiency.

(b) Draw torque slip characteristics of 3-phase Induction motor. Explain what will happen if rotor resistance is increased ? Give the application of 3-phase induction motor.

(c) Justify using double revolving field theory that net starting torque in single phase induction motor is zero. Explain various methods of starting single phase Induction motors.

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