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

PAPER ID : 2302   Roll No.

B. Tech.

(SEM. II) EXAMINATION, 2008-09
ELECTRICAL ENGINEERING

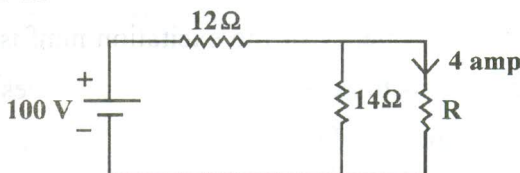*Time : 3 Hours]*   *[Total Marks : 100*

SECTION - A

1   Attempt **all** the parts of the following :   **10×2=20**
     (Fill in the blank/choose/match/determine)

     (i)   In the circuit of following figure, find the value
            of R.

     (ii)   The value of the voltage of an independent voltage
            source is _____ (dependent/not dependent) on
            either the magnitude or direction of the current
            flowing through the source.

     (iii) A voltage $v(t) = 170 \sin(377t + 10°)$ is applied
            to a circuit. It causes a steady-state current to
            flow which is described by $i(t) = 14.14$
 $\sin(377t - 20°)$. The power factor of the circuit
            is _____.

(iv) The effective value of a sinusoid i (t) = Imsinwt is equal to _____ .

(v) A balanced star-connected load is supplied from a symmetrical 3-phase, 400 V (line to line) supply. The current in each phase is 50A and lags 30° behind the phase voltage. The phase impedance is equal to _____ .

(vi) The full-scale deflection current of a meter is 1mA and its internal resistance is 100 Ω. If this meter is to have full scale deflection when 100V is measured, the value of series resistor should be _____ Ω.

(vii) The normal secondary distribution voltage in our country is _____ V.

(viii) If the frequency of the excitation mmf is f. The hysteresis losses and eddy-current losses would be proportional to _____ and _____ respectively.

(ix) In a armature winding of a 4-pole, lap-wound dc machine having 760 active conductors and running at 1200 rpm with 20 mWb flux per pole, the induced voltage would be _____ V.

(x) A three-phase induction motor has 4 pole runs at 4% slip and full load. If the speed of the motor is 720 rpm, the supply frequency is _____

SECTION - B

2   Attempt any **three** parts of the following : $10\times3=30$

(a)   (i)   Use Thevenin's theorem to replace the three
loop circuit of following figure by a single-
loop equivalent circuit in which the identity
of R_L is preserved.
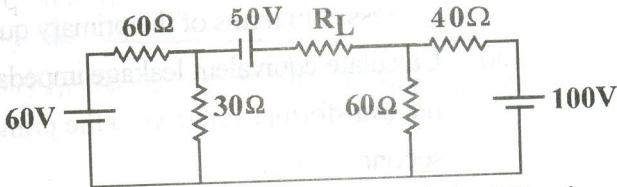
(ii)   Discuss the characteristics of the following
elements:

(a)   Capacitor

(b)   Inductor

(b)   Derive the quality factor Q_o of the series RLC
circuit at resonance. Discuss the expression of
Q_o in terms of energy.

(c)   Derive the relationship between line current, phase
current, line voltage and phase voltage in a
3-phase star-connected and delta-connected
circuits.

(d)   A 100 kVA, 1100/220 V, 60 Hz transformer has
a high-voltage winding resistance of 0.1 Ω and
a leakage reactance of $0.3\,\Omega$. The low-voltage
winding resistance is 0.004 Ω and the leakage
reactance is 0.012 Ω. The source is applied to
high-voltage side :

(i) Find the equivalent winding resistance and reactance referred to the high-voltage side and low-voltage side.

(ii) Compute the equivalent resistance and equivalent reactance drops in volts and in per cent of the rated winding voltages expressed in terms of the primary quantities.

(iii) Calculate equivalent leakage impedances of the transformer referred to the primary and secondary sides.

(e) Describe the difference between the separately excited shunt generator and the self-excited one. Explain the process of voltage built up in a self-excited shunt generation.
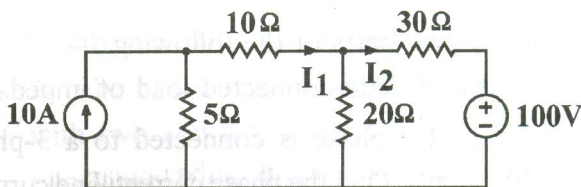
SECTION - C   10×5=50

3   Attempt any **two** parts of the following :

(i) Apply Norton's theorem to find the Norton equivalent circuit as seen by R_L in the circuit shown in the following figure :
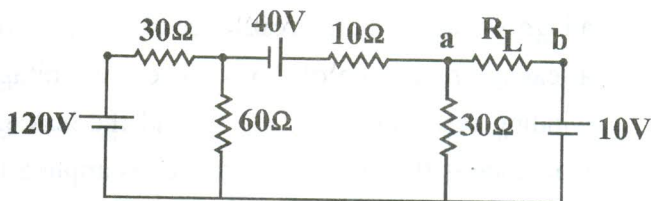
(ii) Solve for I_1 and I_2 of the network of the following figure by nodal analysis.

(iii) When is the Δ-Y transformation useful in network reduction? Illustrate.

4   Attempt any **two** parts of the following :

(i)   A voltage source of e (t) = 141 sin 377t is applied to two parallel branches. The time expression for the current in the first branch is

$i_1(t) = 7.07 \sin (\omega t - \pi/3)$. In the second

branch it is $i_2 (t) = 10 \sin (\omega t + \pi/6)$. Compute

the total power supplied by the source.

(ii) Refer to the circuit shown in the following figure. Find (a) rms line current (b) power dissipated (c) power factor.
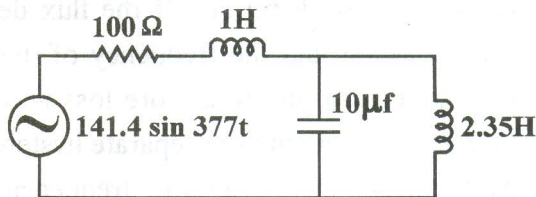
(iii) What are active and reactive powers? Why is the term 'reactive power' not encountered when d-c sources are used in an electric circuit ?

5 Atttempt any **two** parts of the following :

(i) A balanced delta-connected load of impedance $16+j12$ Ω / phase is connected to a 3-phase 400V supply. Find the phase current, line current, power factor, power, reactive VA and total VA.

(ii) Discuss the principle, construction and operation of PMMC type measuring instruments.

(iii) A single phase energy meter has a constant of 1200 revolutions/kWh. When a load of 200 W is connected, the disc rotates at 4.2 revolutions/ minute. If the load is on for 10 hours, how many units are recorded as an error? Also find percentage error.

6 Attempt any **two** parts of the following :

(i) Draw single line diagram of a power system between generating station and end user. Mention the different voltage levels.

(ii) The total core loss (hysteresis plus eddy-current) for a specimen of magnetic sheet steel is found to be 1800 W at 60 Hz. If the flux density is kept constant and the frequency of the supply increased 50%, the total core loss is found to be 3000W. Compute the separate hysteresis and eddy-current losses at both frequencies.

(iii) Develop the equivalent circuit of a single phase transformation on no-load and 'on-load conditions.

7   Attempt any **two** parts of the following :

(i)   A 4-pole, lap-wound armature has 144 slots with two coil sides per slot, each coil having two turns. If the flux per pole is 20 mWb and the armature rotates at 720 rpm, what is the induced voltage?

(ii)   Define slip in 3-phase induction motor. What is its value at starting and at synchronous speed? A 60 Hz induction motor has 2 poles and runs at 3510 rpm. Calculate (a) the synchronous speed and (b) the percent slip.

(iii)   Discuss the principle of operation of a three-phase synchronous machine. Give the various applications of a 3-phase synchronous motor.

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