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

PAPER ID : 2 0 1 9   **Roll No.**

B.Tech.

SECOND SEMESTER EXAMINATION, 2005-2006

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 :   (5x4=20)

(a)   The equation of an alternating current is
$i = 42.42 \sin 628\ t$

Determine

(i)   its maximum value

(ii)   frequency

(iii)   rms value

(iv)   average value

(v)   form factor

(b)   Draw a phasor diagram showing the following voltages

$V_1 = 100 \sin 500\ t$, $V_2 = 200 \sin (500\ t + \pi/3)$ Find RMS value of

$V_3 = -50 \cos 500\ t$, $V_4 = 150 \sin (500\ t - \pi/4)$ resultant voltage

(c) A 120 V, 60 W lamp is to be operated on 220 V, 50 Hz supply mains. In order that lamp should operate on correct voltage. Calculate value of -

  (i) non inductive resistance

  (ii) pure inductance

(d) A series ac circuit has a resistance of 15 Ω and inductive reactance of 10 Ω. Calculate the value of a capacitor which is connected across this series combination so that system has unity power factor. The frequency of ac supply is 50 Hz.

(e) A series R-L-C circuit has R = 10 Ω, L = 0.1 H and C = 8 μF. Determine

  (i) resonant frequency

  (ii) Q-factor of the circuit at resonance

  (iii) the half power frequencies

(f) Explain parallel resonance. Why is parallel resonance called the current resonance ? Show the graphical representation of current in parallel resonance.

2. Attempt *any four* parts of the following :   (5x4=20)

  (a) Using loop current method find the current I_1 and I_2. Shown in Fig. 1.
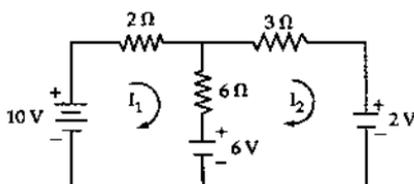

Fig. 1.

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(b) Use nodal analysis to find the currents in various resistors of the circuit shown (Fig. 2.0)
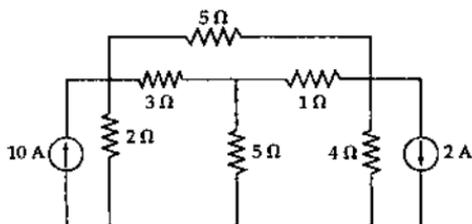

Fig. 2.0

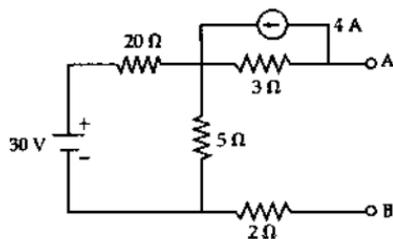(c) Find Thevinin's equivalent circuit across A B Shown in Fig. 3.0

Fig. 3.0

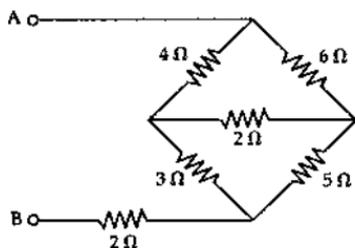(d) Find the resistance between A B of the circuit shown in Fig. 4.0 use Y-Δ (star-delta) transformation.

Fig. 4.0

(e) A 50 A, 230 V meter on full load test makes 61 revolutions in 37 seconds. If the normal disc speed is 500 revolutions per kWh, find the percentage error.

(f) Explain the working principle of induction type wattmeter with the help of diagram.

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3. Attempt *any two* parts of the following :   (10x2=20)

(a) Derive expression for power in 3 phase star and delta connections. A balanced star connected load of $(8+j6)\Omega$ per phase is connected to a balanced 3-phase, 400 V supply. Find the line current, power factor and power.

(b) Explain basic principle of operation of a single phase transformer. Where are they used ? Calculate the voltage regulation of a transformer in which ohmic drop is 1% and reactance drop 5% of the voltage at the following power factor (i) 0.8 lagging (ii) 0.8 leading.

(c) Single phase transformer gave following test results : Rating 100 kVA, 11 kV/220V , 50 Hz

OC test   : 220 V, 45 A, 2 kW

SC test   : 500 V, 9.09 A, 3 kW

Determine equivalent circuit parameters referred to *l*.V. side.

4. Attempt *any four* parts of the following :   (5x4=20)

(a) Derive e.m.f. equation of a d.c. generator. What will be change in e.m.f. induced if flux is reduced by 20% and the speed is increased by 20%.

(b) Why does the terminal voltage of d.c. shunt generator fall when it is loaded ? Explain with the help of load characteristics.

(c) Describe one method to control the speed of D.C. shunt motor.

(d) What are different losses in d.c. machines on what factors they depend.

(e) Explain principle of operation of electromechanical energy conversion.

(f) Explain V-curve and give applications of synchronous motor.

5.   Attempt *any four* parts of the following :   (5x4=20)

(a)   Why is problem of starting in single phase induction motor ? Describe one method to start it.

(b)   Explain Star-Delta starter used for starting 3 phase induction motor.

(c)   Define slip in 3-phase induction motor. What is its value at starting and at the synchronous speed. Draw torque-slip characteristics of 3-phase induction motor.

(d)   A 3-phase, 4-pole induction motor is supplied from 3-phase, 50 Hz ac supply. Calculate :

(i)   the synchronous speed.

(ii)   the rotor speed when slip is 4%.

(iii)   the rotor frequency when rotor runs at 600 r.p.m.

(e)   Give applications of 3-phase induction motor and single phase induction motor. Why is 3-phase induction motor used for medium and large load and single phase induction motor for small load applications.

(f)   Explain principle of operation of three phase induction motor.

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