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10ELE15/25

First/Second Semester B.E. Degree Examination, June 2012

Basic Electrical Engineering

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, choosing at least two from each part.***
2. ***Answer all objective type questions only on OMR sheet page 5 of the answer booklet.***
3. ***Answer to objective type questions on sheets other than OMR will not be valued.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Choose your answers for the following :

i) The current in 5 ohm resistor is

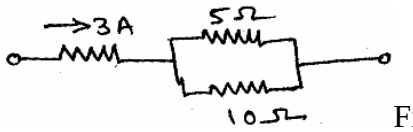

Fig.Q1(a)(i)

A) 2A
B) 3A
C) 1A
D) 1.5A

ii) The total resistance of parallel circuit is
A) less than the smallest resistance B) more than the smallest resistance
C) more than the highest resistance D) none of these

iii) Inductance opposes _____ in current in a circuit.
A) only increase B) only decrease C) change D) none of these

iv) If coefficient of coupling between two coils is increased, mutual inductance between the coils _____.
A) is increased B) is decreased
C) remains unchanged D) none of these **(04 Marks)**

b. List out advantages of parallel circuit over series circuit. List out characteristics of parallel circuit. **(06 Marks)**

c. Deduce an expression for stored energy in a magnetic field. **(04 Marks)**

d. Find current in the battery, the current in each branch and p.d. across AB in the network shown in Fig.Q1(d). **(06 Marks)**

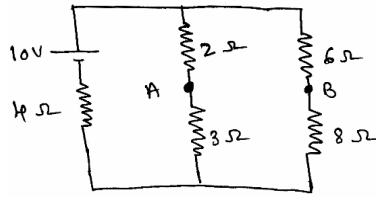

Fig.Q1(d)

2 a. Choose your answers for the following :

i) A coil is rotating in the uniform field of a 10-pole generator. In one revolution of the coil, the number of cycles generated by voltage is _____.
A) 10 B) 5 C) 2.5 D) 4

ii) The average value of sine wave over a one complete cycle is
A) zero B) +1 C) –1 D) $\frac{1}{2}$

iii) The voltage of the applied source in the circuit of fig.Q2(a)(iii) is

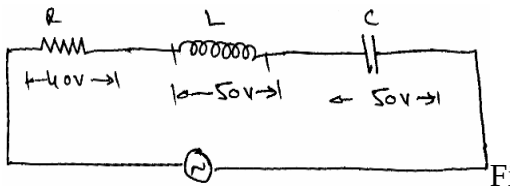

Fig.Q2(a)(iii)

A) 50 V
B) 100 V
C) 40 V
D) 140 V

2 a iv) The power taken by the circuit shown is

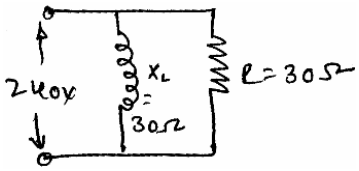

Fig.Q2(a)(iv)

A) 480 W
B) 1920 W
C) 1200 W
D) none of these **(04 Marks)**

b. With the help of circuit diagram and phasor diagram, find the phase angle, impedance and power in case of R-L series circuit. **(08 Marks)**

c. An alternating current of frequency 60 Hz has a maximum value of 120 A.
   i) Write down equation for the instantaneous value.
   ii) Reckoning time from the instant the current is zero and becoming positive, find the instantaneous value after 1/360 sec.
   iii) Time taken to reach 96 A for the first time. **(04 Marks)**

d. A 60 Ω resistor is connected in parallel with an inductive reactance of 80 Ω to a 240 V, 50 Hz supply. Calculate: i) The current through the resistor and inductance, ii) The supply current, iii) The circuit phase angle. Draw phasor diagram. **(04 Marks)**

3 a. Choose your answers for the following :
   i) Three inductive coils each having an impedance of 17.7 Ω are connected in star. The circuit is fed from a 3-phase, 400 V, 50 Hz supply. The current (line) drawn by the circuit is equal to
   A) 22.6 A B) 39.14 A C) 13 A D) none of these
   ii) For a 3-phase star connected balanced circuit having inductive load, the angle between the line currents and corresponding line voltages is equal to
   A) 30^o B) $30^o - \phi$ C) $30^o + \phi$ D) ϕ
   iii) When two wattmeters are connected in a 3-phase circuit to measure its total power consumption, one of the wattmeter would read zero, when the load power factor is,
   A) 0.2 lagging B) unity C) 0.5 lagging D) zero
   iv) Active power drawn by a 3-phase balanced load is given by
   A) $P = V_L I_L \cos\phi$ B) $P = \sqrt{3}\, V_L I_L$
   C) $P = \sqrt{3}\, V_L I_L \cos\phi$ D) $P = \sqrt{3}\, V_{ph} I_{ph} \cos\phi$ **(04 Marks)**

b. With the aid of a phasor diagram obtain the relationship between the line and phase values of voltages in a three-phase, star connected system. **(08 Marks)**

c. The three arms of a three-phase load each comprise an inductor of resistance 25 Ω and of inductance 0.15 H in series with a 120 μF capacitor. The supply voltage is 415 V, 50 Hz. Calculate the line current and total power in watts, when the three arms are connected in delta. **(08 Marks)**

4 a. Choose your answers for the following :
   i) The type of wattmeter commonly used for measurement of power in ac circuit is
   A) rectifier type B) dynamometer type
   C) moving iron type D) thermo-couple type
   ii) In energy meter, constant speed of rotation of disc is provided by
   A) shunt magnet B) series magnet
   C) braking magnet D) none of these
   iii) Earthing of electrical installation is carried out to protect
   A) equipments from damage B) personnel against electric shock
   C) equipments from short circuit D) all of these
   iv) The effect of electric current on vital human organs depends upon
   A) magnitude of current B) duration of current
   C) frequency of current D) all of these **(04 Marks)**

4 b. With a neat sketch, explain the construction and principle of operation of single phase induction type energy meter. **(08 Marks)**

c. Name different types of domestic wiring and explain any one type of wiring. **(05 Marks)**

d. List out some safety measures against electric shocks. **(03 Marks)**

PART – B

5 a. Choose your answers for the following :

i) The rotating part of d.c. machine is called _____.

A) armature B) field system C) frame D) yoke

ii) E.M.F. of d.c. machine s inversely proportional to

A) flux/pole B) poles

C) conductors D) number of parallel paths

iii) Torque in d.c. motor is proportional to

A) only flux B) only I_a

C) both flux and I_a D) none of these

iv) At the moment of starting a d.c. motor, its back emf is

A) zero B) maximum C) minimum D) optimum **(04 Marks)**

b. Derive e.m.f. equation of a d.c. generator. **(06 Marks)**

c. Explain the principle of torque production in d.c. motor. **(04 Marks)**

d. An 8-pole, lap-connected armature has 40 slots with 12 conductors per slot, generates a voltage of 500 V. Determine the speed at which it is running if the flux per pole is 50 mwb. **(06 Marks)**

6 a. Choose your answers for the following :

i) Which of the following does not change in an ordinary transformer?

A) voltage B) current C) frequency D) all of these

ii) A transformer has full load copper loss of 800 W and core loss of 600 W. Total loss at no load will be approximately.

A) 1400 Watts B) 1100 Watts C) 1000 Watts D) 600 Watts

iii) The efficiency of a transformer at fuel load 0.8 pf lag is 95%. The efficiency at 0.8 pf lead is

A) 99% B) 95.5% C) 95% D) 90%

iv) A single phase transformer has 250 turns on primary and 1000 turns on the secondary winding. If the primary winding is connected across a 230 V, 50 Hz, single phase supply, the voltage induced in the secondary winding is

A) 920 V B) 230 V C) 1840 V D) 690 V **(04 Marks)**

b. Explain briefly the principle of operation of transformer and show that the voltage ratio of the primary and secondary winding is the same as their turns ratio. **(08 Marks)**

c. A transformer is rated at 100 KVA. At full load its copper loss is 1200 W and its iron loss is 960 W. Calculate:

i) The efficiency at full load, unity power factor

ii) The efficiency at half load, 0.8 p.f.

iii) The load KVA at which maximum efficiency will occur

iv) Maximum efficiency at 0.85 p.f. **(08 Marks)**

7 a. Choose your answers for the following :

i) The frequency of voltage generated by an alternator having 8-poles and rotating at 250 rpm is

A) 60 Hz B) 50 Hz C) 25 Hz D) $16\frac{2}{3}$ Hz

7 a. ii) In modern alternators, the rotating part is
A) field B) armature
C) field and armature D) none of these

iii) An alternator has a phase sequence of RYB for its phase voltage. In case the direction of rotation of alternator is reversed, the phase sequence will become
A) RBY B) RYB
C) YRB D) none of these

iv) Alternators have short-pitched winding so as to
A) increase machine rating B) improve the voltage waveform
C) improve generated voltage D) none of these **(04 Marks)**

b. Explain the essential difference between cylindrical and salient pole rotors. **(04 Marks)**

c. Derive e.m.f equation of an alternator. **(06 Marks)**

d. A 3-phase, 6-pole, star connected alternator revolves at 1000 rpm. The stator has 90 slots and 8 conductors per slot. The flux per pole is 0.05 wb. Calculate voltage generated, if $K_W = 0.96$. **(06 Marks)**

8 a. Choose your answers for the following :

i) The speed at which the rotating magnetic field produced by stator currents rotates is
A) synchronous speed B) rotor speed
C) greater than synchronous speed D) none of these

ii) When an induction motor is at standstill its slip is
A) zero B) 0.5 C) 1 D) infinity

iii) If N_S is synchronous speed and 's' is the slip, then the actual running speed of an induction motor will be
A) N_S B) sN_S C) $(1 - s)N_S$ D) $(N_S - 1)s$

iv) Initial starting current drawn by a 3-phase induction motor in terms of full load current on application of rated voltage (approximately) is:
A) equal to full load current B) 2 times
C) more than 10 times D) 5 times (appx) **(04 Marks)**

b. Explain the principle of operation of a 3-phase induction motor. **(06 Marks)**

c. Deduce an expression for the frequency of rotor current in an induction motor. **(04 Marks)**

d. A 3-phase, 6-pole, 50 Hz induction motor has a slip of 1% at no load, and 3% at full load. Determine: i) synchronous speed, ii) no-load speed, iii) full load speed, iv) frequency of rotor at stand still, v) frequency of rotor current at full load. **(06 Marks)**

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