First/Second Semester B.E. Degree Examination, Dec.2013/Jan.2014

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 in OMR sheet page 5 of the answer booklet.*
3. *Answer to objective type questions on sheets other than OMR will not be valued.*

PART – A

1 a. Choose the correct answers for the following :   (04 Marks)
   i) The polarity of voltage drop across a resistor is determined by _____.
   A) the value of resistor   B) the value of current
   C) direction of current in resistor   D) the polarity of source
   ii) Three resistors of 4 Ω, 6 Ω and 9 Ω are connected in parallel in a network. Maximum
   power will be consumed by_____.
   A) 4 Ω resistor   B) 6 Ω resistor   C) 9 Ω resistor   D) all resistors
   iii) The magnitude of statically induced e.m.f. depends on
   A) the coil resistance   B) the flux magnitude
   C) the rate of change of flux   D) all of these
   iv) The direction of induced e.m.f in a conductor (or coil) can be determined by _____.
   A) Work law   B) Ampere's law
   C) Fleming's right hand rule   D) Fleming's left hand rule

   b. Derive equation for energy stored in magnetic field.   (04 Marks)
   c. Find the value of resistance 'R' as shown in Fig.Q1(c), so that current drawn from the source
   is 250 mA. All the resistor values are in ohm.   (06 Marks)

Fig.Q1(c)

   d. Coils A and B in a magnetic circuit have 600 and 500 turns respectively. A current of 8A in
   coil A produces a flux of 0.04 Wb. If coefficient of coupling is 0.2, calculate:
   i) Self inductance of coil A, with B open circuited.
   ii) Flux linkage with coil B.
   iii) The average emf induced in coil B when the flux with it changes from zero to full value
   in 0.02 second.
   iv) Mutual inductance.   (06 Marks)

2 a. Choose the correct answers for the following :   (04 Marks)
   i) A coil is rotating in the uniform magnetic field of an 8 pole generator. In one
   revolution of the coil, the number of cycles generated by the voltage is
   A) one   B) two   C) four   D) eight
   ii) The average value of sin θ over complete cycle is
   A) +1   B) –1   C) zero   D) ½

2 a. iii) In the circuit shown in Fig.Q2(a)(iii), the potential difference across the various elements are shown. What is the source voltage, V?
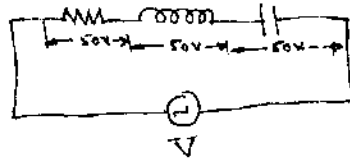

Fig.Q2(a)(iii)

   A) 50 V   B) 100 V   C) zero   D) 150 V

iv) If two phasors $A = 60\underline{|40°}$, $B = (6 + j0)$, then $A/B =$ _____.

   A) $360\underline{|40°}$ B) $60\underline{|40°}$ C) $10\underline{|40°}$ D) $10\underline{|-40°}$

b. Derive r.m.s. value of sinusoidal voltage in terms its maximum value. **(04 Marks)**

c. An inductor coil is connected to supply of 250 V at 50 Hz and takes a current of 5A. The coil dissipates 750 W. Calculate power factor, resistance and inductance of the coil. **(06 Marks)**

d. A capacitor of 50 μF shunted across a non inductive resistance of 100 Ω is connected in series with a resistor of 50 Ω to a 200 V, 50 Hz supply. Find circuit current and power factor. **(06 Marks)**

3 a. Choose the correct answers for the following : **(04 Marks)**

i) The advantage of star-connected supply system is that
A) line-current is equal to phase current
B) line voltage is equal to $\sqrt{3}$ phase voltage
C) two voltage can be used
D) it is simple arrangement

ii) The phase sequence R Y B denotes that
A) the e.m.f of R leads Y by 120°   B) the e.m.f of Y lags R by 120°
C) the e.m.f of Y leads B by 120°   D) all of these

iii) In a three-phase power measurement by two Wattmeter method, both Wattmeters reads the same value. The power factor of the load must be
A) unity   B) 0.707 lag   C) 0.707 lead   D) zero

iv) Three phase apparent power is equal to
A) $\sqrt{3}\, V_L I_L$ B) $\sqrt{3}\, V_L I_L \cos\phi$ C) $\sqrt{3}\, V_L I_L \sin\phi$ D) $V_L I_L$

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. **(06 Marks)**

c. State advantages of three-phase system over a single-phase system. **(04 Marks)**

d. Three identical coils, each having a resistance of 10 Ω and a reactance of 10 Ω are connected in delta, across 400 V, 3-phase supply. Find the line current and the readings on the two Wattmeters connected to measure the power. **(06 Marks)**

4 a. Choose the correct answers for the following : **(04 Marks)**

i) Dynamometer type instruments can be used for
A) A.C. only   B) D.C. only
C) both A.C and D.C   D) none of these

ii) The most commonly used induction type instrument is _____.
A) Voltmeter   B) Ammeter   C) Watt-hour meter   D) Wattmeter

iii) Most modern wiring system for domestic and commercial installation is
A) Cleat wiring   B) Wooden-Batten wiring
C) Wooden-casing wiring   D) Conduit wiring

iv) The fuse wire for smaller current rating (up to 10 A) are made of
A) Lead-tin alloy   B) Copper   C) Lead   D) Aluminium

4 b. Explain with a neat sketch, single phase induction type energy meter. **(06 Marks)**
   c. Explain staircase wiring. **(04 Marks)**
   d. With a neat sketch, explain plate earthing. **(06 Marks)**

PART – B

5 a. Choose the correct answers for the following : **(04 Marks)**
   i)   The number of parallel paths in the armature winding of a four pole, wave connected dc machine having 28 coil-sides is
        A) 28 B) 14 C) 4 D) 2
   ii) The e.m.f generated by a given dc generator depends upon
        A) the flux only   B) the speed only
        C) both flux and speed   D) the terminal voltage
   iii) The back e.m.f in a dc motor is given as
        A) $V + I_a R_a$ B) $V - I_a R_a$ C) V D) $I_a R_a$
   iv) The speed of the d.c. motor is
        A) directly proportional to both its back emf and flux
        B) inversely proportional to both its back emf and flux
        C) directly proportional to flux but inversely proportional to its back emf
        D) directly proportional to its back emf but inversely proportional to flux
   b. Explain working of d.c. motor and hence derive an equation for torque. **(08 Marks)**
   c. An 8-pole generator has 500 armature conductors and has a useful flux per pole of 0.065 Wb. What will be the e.m.f. generated if it is lap connected and runs at 1000 rpm? What must be the speed at which it is to be driven to produce the same emf if it is wave wound? **(08 Marks)**

6 a. Choose the correct answers for the following : **(04 Marks)**
   i)   The core of a transformer is assembled with laminated sheets so as to
        A) reduce hysteresis loss
        B) reduce Eddy current loss
        C) both hysterisis and Eddy current loss
        D) copper loss
   ii) A single phase, 5 kVA, 200 V/100 V, transformer has rated primary and secondary currents at rated voltage
        A) 25 A and 50 A   B) 50 A and 25 A
        C) 12.5 A and 62.5 A   D) 62.5 A and 12.5 A
   iii) If the fuel load core loss of a transformer is 100 W, its core loss at half load will be
        A) 200 W B) 100 W C) 50 W D) 25 W
   iv) A transformer operates at maximum efficiency, when
        A) core losses minimum
        B) copper loss minimum
        C) core loss = copper loss
        D) none of these
   b. Derive expressions for the r.m.s values of induced voltages in the two windings of a single phase transformer connected to a sinusoidal supply. **(05 Marks)**
   c. Deduce the condition for maximum efficiency in a single-phase transformer. **(05 Marks)**
   d. 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, OPF.
      ii) The efficiency at half load, 0.8 pf.
      iii) The load kVA at which maximum efficiency will occur. **(06 Marks)**

(04 Marks)

7 a. Choose the correct answers for the following :
   i) In synchronous generators
       A) the field poles are stationary and the armature conductors rotate
       B) the armature conductors are stationary and the field poles rotate
       C) field and armature both are stationary
       D) none of these
   ii) A 4-pole, 1200 rpm alternater will generate an emf at a frequency of
       A) 60 Hz   B) 50 Hz   C) 40 Hz   D) 25 Hz
   iii) Full pitch windings have coil span of
       A) 180°   B) 90°   C) 270°   D) 360°
   iv) The current from an alternator is taken out to external load circuit through
       A) commutator segments   B) slip-rings
       C) carbon brushes   D) solid connection

   b. By means of a neat diagram, describe the main parts of an alternator with their functions.
   (08 Marks)

   c. 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 (sinusoidally distributed). Calculate the voltage generated by the machine if the winding factor is 0.96 line and phase value.
   (08 Marks)

   (04 Marks)

8 a. Choose the correct answers for the following :
   i) In a three phase induction motor
       A) rotor conductors are open circuited
       B) rotor conductor are short circuited
       C) stator winding is open
       D) none of these
   ii) The relation between N_s, f and P of three-phase inductor is
       A) $N_s = \dfrac{P}{120f}$ B) $N_s = \dfrac{120P}{f}$ C) $f = \dfrac{PN_s}{120}$ D) $f = \dfrac{120N_s}{P}$
   iii) When speed of the induction motor is zero, its slip is
       A) zero   B) 0.5   C) one   D) infinity
   iv) The number of slip rings in a three phase wound rotor induction motor is
       A) 3   B) 4   C) 9   D) 2
   (05 Marks)

   b. Explain the principle of operation of a three phase induction motor.
   (06 Marks)
   c. With the help of neat circuit diagram, explain star-delta starter.
   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 current at stand still ; v) frequency of rotor current at full load.
   (05 Marks)

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