First/Second Semester B.E. Degree Examination, Dec.2014/Jan.2015
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) If 110 V is applied across a 220 V, 100 W bulb, the power consumed by it will be
       A) 100 W B) 50 W C) 25 W D) 12.5 W
   ii) Three resistors of 4Ω, 6Ω and 9Ω are connected in parallel in a network. Maximum power will be consumed by
       A) 4Ω B) 6Ω C) 9Ω D) all resistors
   iii) If an emf of 8V is induced in a coil of inductance 4H, the rate of change of current through it must be
       A) 32 A/sec B) 0.5 A/sec C) 2 A/sec D) 12 A/sec
   iv) The principle of statically induced emf is utilized in
       A) transformer B) motor C) generator D) battery

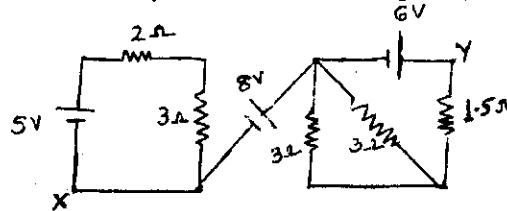   b. Obtain the potential difference V_{xy} in the circuit of Fig.Q1(b).

Fig.Q1(b) **(08 Marks)**

   c. Prove that the coefficient of mutual inductance M between two coils of self inductances L_1 and L_2 is given by $M = K\sqrt{L_1 L_2}$, where K is the coefficient of coupling between the two coils. **(04 Marks)**

   d. Two coils have a mutual inductance of 0.3 H. If the current in one coil is varied from 5A to 2A in 0.4 sec, calculate: i) The average emf induced in the second coil; ii) The change of flux linked with the second coil assuming that it is wound with 200 turns. **(04 Marks)**

2 a. Choose the correct answers for the following : **(04 Marks)**
   i) In an ac circuit, if the active and apparent power are equal in magnitude, then the power factor of the circuit is
       A) 1 B) 0.8 C) 0.6 D) zero
   ii) If a 10Ω resistance is connected to an ac supply $v = 100\sin(314t + 39°)V$, the power dissipated by the resistance is
       A) 10000 W B) 1000 W C) 500 W D) 250 W
   iii) The impedance of an RL circuit is 25Ω at a frequency of 50 Hz. At a frequency of 60 Hz, its impedance will be
       A) greater than 25 Ω B) exactly 25 Ω
       C) less than 25 Ω D) 0 Ω
   iv) The maximum and minimum values of power factor in an ac circuit can be
       A) 1 and 0 B) 0 and 1 C) -1 and -2 D) +10 and -10

b. In case of a pure inductive circuit, obtain the phasor relationship between current and voltage. **(04 Marks)**

c. Obtain an expression for power in a series RLC circuit. **(06 Marks)**

d. For the circuit shown in Fig.Q2(d), find: i) The currents in each branch; ii) The source currents and iii) The power factor.
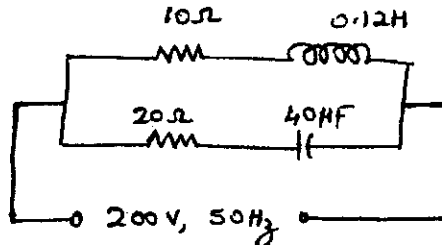

Fig.Q2(d) **(06 Marks)**

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

i) In a 3 phase, 4 wire system, the current in each phase is 15 A. The current in the neutral wire will be
   A) 15 A   B) 30 A   C) 45 A   D) zero

ii) If P is the total power consumed when three equal impedances are connected in star, then the total power consumed when the same three impedances are connected in delta is
   A) P   B) 3P   C) P/3   D) zero

iii) In a three-phase system, the emfs in each phase are
   A) 30° apart   B) 60° apart   C) 90° apart   D) 120° apart

iv) In a three phase power measurement by two Wattmeter method, both Wattmeters read the same value the power factor of the load must be
   A) unity   B) 0.707 lagging   C) 0.707 leading   D) zero

b. With neat circuit diagram and phasor diagram, show that two Wattmeters are sufficient to measure power in 3-phase balanced, star connected circuits. **(08 Marks)**

c. A balanced 3-phase, star connected load of 100 KW takes a leading current of 80 A when connected to a 3-phase, 1.1 KV, 50 Hz supply. Find the resistance, impedance and capacitance per phase. Also calculate power factor. **(08 Marks)**

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

i) The electric energy meter installed near the mains switch in a home is
   A) an indicating instrument   B) an integrating instrument
   C) a recording instrument   D) an absolute instrument

ii) In a dynamometer Wattmeter; the fixed coil is
   A) current coil   B) potential coil
   C) current or potential coil   D) none of these

iii) What type of switch is used as the main switch near the energy meter in residential buildings?
   A) DPST   B) SPST   C) DPDT   D) none of these

iv) In case of three-way control of a lamp, how many switches are used?
   A) 3   B) 2   C) 1   D) none of these

b. With a neat diagram, explain the working of a 1 phase induction type energy meter. **(08 Marks)**

c. Explain the necessity of earthing. Explain pipe earthing with a neat diagram. **(08 Marks)**

PART – B

5 a. Choose the correct answers for the following : (04 Marks)
   i) The emf induced in each conductor of the armature in a dc machine is
      A) alternating in nature   B) direct in nature
      C) pulsating in nature   D) none of these
   ii) A 220 V, DC machine has an armature resistance of 1 Ω. If the full-load current is 20 A, the difference in the induced emf when the machine is running as a generator and as a motor is
      A) zero   B) 20 V   C) 40 V   D) 220 V
   iii) In a dc motor, the torque developed is 20 N-m at a current of 20 A. If the current is doubled, the torque developed becomes
      A) 20 Nm   B) 40 Nm   C) 80 Nm   D) 160 Nm
   iv) Which dc motor will be preferred for constant speed?
      A) compound motor B) series motor   C) shunt motor   D) none of these

b. Derive an expression for torque in a DC motor. (06 Marks)
c. Explain why starters are necessary for staring a DC motor. (02 Marks)
d. A 4-pole, 500 V, DC shunt motor has 720 wave connected conductors on its armature. The full load armature current is 60 A and the flux per pole is 0.03 wb. The armature resistance is 0.2 Ω and the contact drop is 1 Volt per brush. Calculate the full load speed of the motor. (08 Marks)

6 a. Choose the correct answers for the following : (04 Marks)
   i) If an ammeter in the primary of a 100V/10V transformer reads 1A, the current in the secondary would be
      A) 10 A   B) 2 A   C) 1 A   D) 100 A
   ii) The core of a transformer is laminated so as to
      A) reduce hysteresis loss   B) reduce eddy current loss
      C) reduce copper loss   D) reduce friction loss
   iii) If the full load copper loss of a transformer is 100 W, its copper loss at half load will be
      A) 200 W   B) 100 W   C) 50 W   D) 25 W
   iv) If the supply frequency changes from 50 Hz to 60 Hz, then the transformation ratio E_1/E_2
      A) remains the same B) increases   C) decreases   D) equal to zero

b. With a neat sketch, explain the construction of core type and shell type transformers. (06 Marks)
c. Obtain the condition for maximum efficiency. (04 Marks)
d. In a 50 KVA, 11 KV/400 V single phase transformer, the iron and copper losses are 500 W and 600 W respectively under rated conditions. Calculate: i) Efficiency at unity power factor at full load, ii) The load for maximum efficiency and iii) The copper loss for this load. (06 Marks)

7 a. Choose the correct answers for the following : (04 Marks)
   i) The stator core of a synchronous machine is built of laminations of
      A) stainless steel   B) silicon steel   C) cast steel   D) iron
   ii) The machine that supplies DC power to the rotor of a synchronous machine is called
      A) rectifier   B) inverter   C) converter   D) exciter
   iii) The maximum possible speed at which an alternator can be driven to generate an emf of 50 Hz is
      A) 1500 rpm   B) 3000 rpm   C) 3600 rpm   D) 4000 rpm
   iv) The salient pole type rotors have
      A) smaller diameter   B) larger diameter
      C) smaller axial length   D) both B and C

b. Derive an emf equation of ac generator. **(06 Marks)**
c. State the advantages of having rotating field system rather than a rotating armature system in a synchronous machine. **(04 Marks)**
d. A 4 pole, 3 phase, 50 Hz, star connected alternator has a single layer winding in 36 slots with 30 conductors per slot. The flux per pole is 0.05 wb and the winding is full pitched. Find the synchronous speed and the line voltage on No load. Assume winding factor as 0.96. **(06 Marks)**

8 a. Choose the correct answers for the following : **(04 Marks)**
    i) The rotor circuit of a three-phase induction motor under running condition is
        A) always closed   B) always open
        C) sometimes closed and sometimes open   D) none of these
    ii) When an induction motor is standstill, its slip is
        A) zero   B) 0.5   C) 1   D) infinity
    iii) Synchronous speed of a three phase induction motor is given by
        A) $N_s = \dfrac{120f}{P}$ B) $N_s = 120\,fP$ C) $N_s = \dfrac{120P}{f}$ D) $N_s = \dfrac{fP}{120}$
    iv) An induction motor works with
        A) DC only   B) AC only
        C) both AC and DC   D) none of these
b. Explain the principle of operation of a 3 phase induction motor. **(04 Marks)**
c. Define slip. Derive an expression for frequency of rotor current. **(06 Marks)**
d. A 3 phase, 12 pole alternator is driven by an engine running at 500 rpm. The alternator supplies an induction motor which has a full load speed of 1455 rpm. Find the slip and the number of poles of the motor. **(06 Marks)**

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