USN ☐☐☐☐☐☐☐☐☐☐   10ELE15/25

First/Second Semester B.E. Degree Examination, June/July 2011
Basic Electrical Engineering

Time: 3 hrs.   Max. Marks:100

Note: 1. *Answer 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 answer:
   i) As per Ohms law
      A) $V \alpha I$ B) $V \alpha R$ C) $I \alpha R$ D) $V = IR$.

   ii) A 2 Ω resistor is connected in series with parallel combination of 10 Ω and 15 Ω resistors. Then heat dissipated in kWsec for 1 hour in circuit, when current of 2 A flowing in 2 Ω resistor is.
      A) 115.5   B) 1.152   C) 11.52   D) 115200

   iii) The flux linkage between the coils is maximum, when m = ?
      A) $\frac{1}{\sqrt{L_1 L_2}}$ B) $\sqrt{L_1 L_2}$ C) $L_1 = L_2$ D) L_1/L_2.

   iv) If the energy stored in a coil is 2 joules for a current of 2A flowing, then the inductance of coil is,
      A) 0.01 H   B) 0.1 H   C) 1H   D) 10H.   **(04 Marks)**

   b. State and explain Kirchoff's laws as applied to DC circuits.   **(06 Marks)**

   c. Explain Fleming's right hand rule and Fleming's left hand rule as applied to electrical machines.   **(06 Marks)**

   d. Find the self inductance of a coil of 200 turns, wound on a paper core tube of 25 cm length and 5 cm radius. Also calculate energy stored in it if current rises from 0 to 5A (l/r for paper = 1).   **(04 Marks)**

2 a. Choose the correct answer:
   i) Given $(8 + j6) \times (-10 - j7.5)$, then the result in polar form is
      A) $12.5 \lfloor -143.1$ B) $125 \lfloor -106.2°$ C) $125 \lfloor +106.2°$ D) $12.5 \lfloor 143.1$

   ii) An alternating emf is given by $e = 200\sin 314t$. The instantaneous value of emf at $t = 1/200$ sec is
      A) 150 V   B) 175 V   C) 200 V   D) 225 V.

   iii) An alternating current is given by $I = I_m \sin 2\omega t$. Then frequency of the alternating current is,
      A) ω/π Hz   B) $2\omega/\pi$ Hz   C) $\omega/2\pi$ Hz   D) none of these

   iv) The reactance of a capacitor at 50 Hz is 5Ω. If the frequency is increased to 100 Hz, the new reactance is,
      A) 5 Ω   B) 2.5 Ω   C) 10 Ω   D) 25 Ω.   **(04 Marks)**

   b. Define average and RMS value of all alternating current and find their relation with max value, if the alternating quantity is sinusoidal.   **(08 Marks)**

c. In a series parallel circuit, the two parallel branches A & B are in series with C. The impedances are $Z_A = (10 - j8)\Omega$, $Z_B = (9 - j6)\Omega$ & $Z_C = (3 + j2)\Omega$. The voltage across branch C is 100V. Find the currents I_A & I_B and the phase difference between them.

(08 Marks)

3 a. Choose the correct answer:
   i) When power factor is 0.5, the wattmeter reading is such that
      A) $w_1 = w_2$ B) w_1 is +ve, w_2 is –ve   C) w_1 is +ve, $w_2 = 0$ D) $w_1 = 2 w_2$.

   ii) The relation between line and phase quantities in a delta connection is
      A) $E_l = \sqrt{3}\ E_{ph}, I_l = I_{ph}$ B) $E_l = E_{ph}, I_l = \sqrt{3}\ I_{ph}$

      C) $E_l = \sqrt{3}\ E_{ph}, I_l = \sqrt{3}\ I_{ph}$ D) $E_l = E_{ph}, I_l = I_{ph}$.

   iii) The angle between line voltage and phase voltage for a balanced star connected circuit is
      A) 30°   B) 30° ± φ   C) 60°   D) 120°.

   iv) In a 3φ system, if the instantaneous value of phase R and Y are +60V and –40V respectively, then instantaneous voltage of phase B is
      A) – 20 V   B) 40 V   C) 120 V   D) none of the above. **(04 Marks)**

   b. What are the advantages of 3φ AC systems over 1φ AC system? **(04 Marks)**

   c. Show that two wattmeters are sufficient to measure 3φ power for balanced 3φ power system. **(06 Marks)**

   d. Three coils each of impedance 20∟60° are connected in star to a 3φ, 400 V, 50 Hz supply. Find the reading on each of the two wattmeters connected to measure the power input. **(06 Marks)**

4 a. Choose the correct answer:
   i) Under no load condition, the revolution of the disc due to kinetic energy of an energy meter can be blocked by
      A) Brake magnet   B) Electromagnet
      C) Creeping hole with Brake magnet   D) Copper shading band.

   ii) The minimum fusing current of a fuse wire is 2.1 A and fusing factor is 1.1. Then, the rated carrying current of the fuse element is,
      A) 2.2 A   B) 2.31 A   C) 1.909 A   D) 0.5238 A.

   iii) Coke can be used as a sandwich between salt of an earthing system, to
      A) by pass the current   B) avoid melting of the salt
      C) improve conductivity   D) to hold moisture content.

   iv) When the pointer of an indicating instrument comes to rest in the final deflection position, then
      A) Only controlling torque acts   B) Only deflecting torque acts
      C) Both torques act   D) None of these. **(04 Marks)**

   b. With the help of a neat diagram, describe the constructional features and working of a dynamometer type wattmeter. **(06 Marks)**

   c. With a neat sketch, explain any three types of wiring. **(06 Marks)**

   d. What are the precautions to be taken to prevent electric shock? **(04 Marks)**

PART – B

5 a. Choose the correct answer:
   i) The yoke of a DC machine is made of
      A) Silicon steel   B) Soft iron   C) Aluminum   D) Cast steel.

   ii) Carbon brushes are used in a DC machine because
      A) Carbon lubricates and polishes the commutator   B) Contact resistance is decreased
      C) Carbon is cheap   D) none of these.

   iii) The efficiency of a DC generator means its
      A) Electrical efficiency   B) Overall efficiency
      C) Mechanical efficiency   D) None of the above.

   iv) A DC motor is still used in industrial applications because it is
      A) Cheap   B) Simple in construction
      C) Provides fine speed control D) none of these   **(04 Marks)**

   b. Explain with a neat sketch the constructional features of a DC machine and mention the
       function of each part.   **(05 Marks)**

   c. What is the significance of back emf under no load and full load condition in a DC motor?
                                      (04 Marks)

   d. A 4 pole DC shunt motor takes 22A from 220V supply. The armature and field resistances
       are respectively 0.5 Ω and 100 Ω respectively. The armature is lap connected with 300
       conductors. If the flux per pole is 20 mWb, calculate the speed and gross torque.   **(07 Marks)**

6 a. Choose the correct answer:
   i) A transformer transfers electrical energy from primary to secondary usually with a
       change in
      A) frequency   B) power   C) voltage   D) time period.

   ii) when the supply frequency of a transformer is doubled then the hystersis losses
      A) remain same   B) doubled
      C) reduced by 50%   D) hystersis loss equal to eddy current loss.

   iii) Regulation and efficiency of a transformer should be respectively
      A) high, high   B) high, low
      C) low, high   D) low, low

   iv) The full load copper loss for a transformer is 800 W, then the copper loss at half the full
       load is
      A) 400 W   B) 800 W   C) 200 W   D) 1600 W   **(04 Marks)**

   b. What are the various types of losses and how to overcome these losses in a transformer?
                                      (08 Marks)

   c. The max. efficiency at full load and upf of a 1 φ, 25 KVA, 500 /1000 V, 50 Hz, transformer
       is 98%. Determine its efficiency at i) 75% load, 0.9 pf ii) 50% load, 0.8 pf iii) 25% load,
       0.6 pf.   **(08 Marks)**

7 a. Choose the correct answer:
i) The stater of an alternator is identical to that of a
   A) DC generator   B) three phase induction motor
   C) single phase induction motor   D) none of these.

ii) The field winding of an alternator is _____ excited.
   A) DC   B) AC   C) Both DC and AC   D) none of these

iii) High speed alternators are driven by
   A) diesel engine   B) hydraulic turbines C) steam turbines   D) none of these.

iv) The disadvantages of a short pitched coils in an alternator is that
   A) harmonics are introduced   B) waveform become non sinusoidal
   C) voltage round the coil is reduced D) none of the above.   **(04 Marks)**

b. Derive an expression for emf equation of an alternator. What is the necessity of considering pitch factor and distribution factor for emf equation?   **(08 Marks)**

c. A 12 pole, 500 rpm, $\curlywedge$ connected alternator has 60 slots, with 20 conductors per slot. The flux per pole is 0.02 wb and is distributed sinusoidally. The winding factor is 0.97. Calculate
   i) frequency   ii) phase emf   iii) line emf.   **(08 Marks)**

8 a. Choose the correct answer:
i) The difference between synchronous speed and actual speed is 100 rpm and the synchronous speed is 1500 rpm, then the value of slip is
   A) 2%   B) 10%   C) 6.66%   D) 15%.

ii) External resistance is connected to the rotor of a 3ϕ phase wound induction motor in order to
   A) reduce starting current   B) connector current
   C) as a star connected load   D) none of these.

iii) When the rotor of a 3ϕ induction motor is blocked, the slip is
   A) zero   B) 0.5   C) 0.1   D) 1.

iv) Phase wound induction motors are less extensively used than squirrel cage induction motors because,
   A) slip rings are required on the rotor circuit
   B) rotor windings are generally star connected
   C) they are costly and require greater maintenance
   D) none of the above.   **(04 Marks)**

b. Explain the working principle of a 3ϕ induction motor and give reasons for "An induction motor can not run at synchronous speed".   **(06 Marks)**

c. Define slip. Derive an expression for frequency of rotor current.   **(04 Marks)**

d. An 8 pole alternator runs at 750 rpm, and supplies power to a 6 pole, 3ϕ induction motor which runs at 970 rpm. What is the slip of the induction motor?   **(06 Marks)**

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Note: 1. *Answer any FIVE full questions, choosing at least TWO from each part.*
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PART – A

1 **a.** Choose your answers for the following :
  i) Electrical appliances are connected in parallel because it
   A) is a simple circuit
   B) draws less current
   C) results in reduced power loss
   D) makes the operation of appliances independent of each other
  ii) Two electric bulbs rated for the same voltage have powers of 200 W and 100 W. If their resistances are respectively R_1 and R_2, them,
   A) $R_1 = 2R_2$ B) $R_2 = 2R_1$ C) $R_2 = 4R_1$ D) $R_1 = 4R_2$
  iii) The main advantage of temporary magnets is that we can
   A) Change the magnetic flux   B) Use any magnetic material
   C) Decrease the hysteresis loss   D) None of these
  iv) Mutual inductance between two coils is 4H. If the current in one coil changes at the rate of 2A/sec, then emf induced in the other coil is
   A) 8V   B) 2V   C) 0.5V   D) 0V   **(04 Marks)**
  b. State and explain Kirchoff's laws with electric circuits.   **(06 Marks)**
  c. Two resistors $R_1 = 2500\ \Omega$ and $R_2 = 4000\ \Omega$ are joined in series and connected to 100 V supply. The voltage drop across R_1 and R_2 are measured successively by a voltmeter having a resistance of 50,000 Ω. Find the sum of the two readings.   **(05 Marks)**
  d. An air cored solenoid of 500 turns has a mean length of 50 cm and diameter of 2cm. Determine the energy stored in the inductor, if the current rises from 0 to 10A in 50 msec.   **(05 Marks)**

2 **a.** Choose your answers for the following :
  i) The inductive reactance of an inductor in a d.c. circuit is
   A) ωL B) $\dfrac{1}{\omega L}$ C) zero   D) infinity
  ii) In an a.c. circuit, the instantaneous current and voltage are represented by $i = I_m \sin(\omega t - \pi/6)$ and $v = V_m \sin(\omega t + \pi/3)$. The voltage leads current by
   A) $\pi/3$ B) $\pi/2$ C) $\pi/4$ D) $\pi/6$
  iii) The voltage drop across R, L and C in RLC series circuit is 20V, 85V and 100V respectively. Then the magnitude of applied voltage is
   A) 205 V   B) 35 V   C) 25V   D) None of these
  iv) The active and apparent power of an a.c. circuit are equal in magnitude. The circuit power factor is
   A) 0.707   B) 0.5   C) 0.8   D) 1   **(04 Marks)**

b. Define RMS and average value of an alternating quantity and hence show that form factor for a sine wave is 1.11 **(08 Marks)**

c. Two circuits with the impedances of $Z_1 = 10 + j15\ \Omega$ and $Z_2 = 6 - j8\ \Omega$ are connected in parallel. If the supply current is 20A, determine the current and power dissipated in each branch. **(08 Marks)**

3   a. Choose your answers for the following :
   i) In a three phase system, if the instantaneous values of phase R and Y an +60V and -40V respectively then the voltage of phase B if
      A) -20V   B) 40V   C) 120V   D) None of these
   ii) The power consumed in the 3ϕ, 400V star connected load of RΩ/ph is 690W. The line current is
      A) 2.5 A   B) 1A   C) 1.725 A   D) None of these
   iii) In a 3ϕ circuit, if load power factor is decreased, then the line current
      A) decreases   B) increases   C) remains the same D) None of these
   iv) In a balanced star connected system, the angle difference between line voltages and phase voltages are
      A) 30°   B) 60°   C) 120°   D) in phase
                                                                    (04 Marks)

   b. Show that two wattmeter's are sufficient to measure power in the three phase balanced star connected circuit with the aid of neat circuit diagram. **(06 Marks)**

   c. What are the various types of power available with respect to power triangle in 3ϕ system? **(04 Marks)**

   d. A delta connected load consists of a resistance of 10 Ω and a capacitance of 100 μF in each phase. A supply of 410V at 50 Hz is applied to the load. Find the line current, power factor and power consumed by the load. **(06 Marks)**

4   a. Choose your answers for the following :
   i) Dynamometer type instruments are used to measure parameters of
      A) DC only   B) AC only   C) both DC and AC   D) None of these
   ii) The pointer of an indicating instruments are generally made of
      A) Copper   B) Aluminium   C) Silver   D) Soft steel
   iii) The fusing material should have
      A) Low melting point, low resistivity   B) Low melting point, high resistivity
      C) high melting point, Low resistivity   D) high melting point, high resistivity
   iv) In a 1ϕ AC supply, the voltage measured between phase and ground is
      A) 0 V   B) <5 V   C) 230 V   D) None of these
                                                                    (04 Marks)

   b. Define earthing for electrical appliances and need of it. With a neat sketch, explain the pipe earthing. **(08 Marks)**

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

PART – B

5 a. Choose your answers for the following :
   i) The armature of a D.C. machine is made of
      A) Silicon steel   B) Wrought iron
      C) Cast steel   D) Soft iron
   ii) High voltage dc machines use _____ windings
      A) Lap   B) Wave
      C) Either lap or wave   D) Combination of both
   iii) A DC motor is still used in industrial applications because it
      A) is cheap   B) is simple in construction
      C) provides fine speed control   D) None of these
   iv) The torque developed by a d.c. motor is directly proportional to
      A) flux per pole X armature current   B) armature resistance X applied voltage
      C) armature resistance X armature current   D) applied voltage X number of poles
      (04 Marks)

   b. Explain the characteristics of a dc shunt and dc series motor for torque versus armature current and speed versus armature current. **(08 Marks)**
   c. A 440 V dc shunt motor takes an armature current of 20 A and runs at 500 RPM. The resistance of the armature is 0.6 Ω. If the flux is reduced by 30% and the torque is increased by 40% what are the values of armature current and speed? **(08 Marks)**

6 a. Choose your answers for the following :
   i) A transformer is an efficient device because it
      A) is a static device   B) uses inductive coupling
      C) uses capacitive coupling   D) uses electric coupling
   ii) The flux in the core of a single phase transformer is
      A) purely alternating one   B) purely rotating one
      C) partly alternating and partly rotating   D) constant flux
   iii) A transformer has 200 W at iron loss at full load. The iron loss at half the full load would be
      A) 50 W   B) 100 W
      C) 400 W   D) 200 W
   iv) The efficiency and regulation of a transformer should be respectively
      A) High, high   B) High, low
      C) Low, high   D) Low, low   **(04 Marks)**

   b. What are the various types of losses occur in transformer and how to minimize them?
      (06 Marks)
   c. Define regulation of a transformer. **(04 Marks)**
   d. A 600 kVA single phase transformer has an efficiency of 92% both at full load and half the full load at UPf. Determine its η at 75% of full load at 0.9 pf lag. **(06 Marks)**

7   a.   Choose your answers for the following :
    i)   The stator of an alternator is identical to that of a
        A) DC generator   B) Three phase induction motor
        C) Single phase induction motor   D) Rosenberg generator
    ii)   The a.c. armature winding of an armature is
        A) Always star connected   B) Generally delta connected
        C) Star – delta connected   D) None of these
    iii) The speed at which a 6 pole alternator should be driven to generate 50 cycles per second is
        A) 1500 RPM   B) 1000 RPM
        C) 500 RPM   D) None of these
    iv) The rating of an armature is expressed in
        A) kW   B) HP
        C) KVA   D) KVAR   (04 Marks)

   b. Derive an expression for emf equation of an armature and also discuss why K_p and K_d have to be considered in the equation. **(08 Marks)**

   c. A 3ϕ, λ connected alternator driven at 900 RPM is required to generate a line voltage of 460 V at 60 Hz on open circuit. The stator has 2 slots/pole/ph and 4 conductor/slot. Calculate the number of poles and the useful flux per pole if the winding factor if 0.966. **(08 Marks)**

8   a.   Choose your answers for the following :
    i)   The relation among N_s, N and S of a 3ϕ induction motor is
        A) $N = (S - 1) N_s$ B) $N = (1 - S) N_s$
        C) $N = (1 + S) N_s$ D) $N = SN_s$
    ii)   When the rotor of a 3ϕ induction motor is blocked to rotate, the slip is
        A) 0   B) 0.5
        C) 0.1   D) 1
    iii) The direction of rotation of field in a 3ϕ induction motor depends upon
        A) Number of poles   B) Magnitude of supply voltage
        C) Supply frequency   D) Phase sequence of supply voltage
    iv) A wound rotor is mainly used in applications where
        A) High starting torque is required   B) Speed control is required
        C) Constant speed is required   D) None of these   (04 Marks)

   b. With a neat sketch, explain the working principle of a 3ϕ squirrel cage induction motor and discuss the significance of slip. **(08 Marks)**

   c. A 4 pole, 50 Hz induction motor has s slip of 1% at no load. When operated at full load, the slip is 2.5 %. Find the change in speed from no load to full load. **(08 Marks)**

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