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.

PART - A

1 a. Choose your answers for the following:
   i) Ohm's law does not hold good for non-metallic conductors such as ______
      A) Copper       B) Aluminium
      C) Silver        D) Silicon carbide
   ii) The direction of magnetic field produced by a linear current is given by ______
      A) Fleming's left hand rule   B) Right hand thumb rule
      C) Ampere's law               D) Lenz's law
   iii) For ideal voltage source, the value of internal resistance is ______
      A) 1             B) ∞
      C) zero          D) None of these
   iv) Equivalent inductance of series aiding of two coil connection is ______
      A) \( L_{eq} = L_1 + L_2 - 2M \)   B) \( L_{eq} = L_1 + L_2 + 2M \)
      C) \( L_{eq} = 2L_1 + 2L_2 + M \)   D) \( L_{eq} = 2L_1 + L_2 - M \)

b. A resistance \( R \) is connected in series with a parallel circuit comprising two resistances of 12 \( \Omega \) and 8 \( \Omega \). The total power dissipated in the circuit is 700 watts when the applied voltage is 700\( \text{V} \). Calculate the value of \( R \). (06 Marks)

c. State and explain Faraday's law of electromagnetic induction and state Lenz's law also. (05 Marks)

d. Two coupled coils of self inductances 0.8 H and 0.20 H, have a coefficient of coupling 0.9. Find the mutual inductance and turns ratio. (05 Marks)

2 a. Choose your answers for the following:
   i) The sinusoidal currents are given by \( i_1 = 10 \sin (wt + \pi/3) \), \( i_2 = 15 \sin (wt - \pi/4) \). The phase difference between them in degrees is ______
      A) 15\(^{\circ}\)   B) 105\(^{\circ}\)   C) 60\(^{\circ}\)   D) 45\(^{\circ}\)
   ii) The peak factor is given by \( K_p = ______\)
      A) 1.414   B) 1.11  C) 0.707   D) 0.635
   iii) When the frequency of the applied voltage in R.L series circuit is increased the inductive reactance ______
      A) decreases   B) becomes zero   C) increases   D) remains same
   iv) The power factor of R.L.C. series circuit, when \( X_L > X_C \)
      A) lagging   B) leading   C) unity   D) zero

b. Derive equations for the rms value and average value of a sinusoidally varying current. (06 Marks)

c. Derive an equation for the power consumed by a R-C series circuit. Draw the waveforms of voltage, current and power. (05 Marks)

d. A circuit consists of a resistance of 20 \( \Omega \) and an inductance of 0.05 H connected in series. A supply of 230V, 50Hz is applied to the circuit. Find the current, power factor and power consumed by the circuit. (05 Marks)
3 a. Choose your answers for the following: (04 Marks)
   i) The algebraic sum of instantaneous phase currents on a three phase balanced system is
      A) one  
      B) zero  
      C) infinity  
      D) none of these
   ii) In star connected system, the relation between the line voltage and phase voltage is
      A) \( E_l = \frac{1}{\sqrt{3}} E_p \)  
      B) \( E_p = \sqrt{3} E_l \)  
      C) \( E_l = \sqrt{3} E_p \)  
      D) \( E_l = 3 E_p \)
   iii) In the two-wattmeter method of measuring 3-phase power, one of the wattmeter reads zero, when the load angle power factor angle is
      A) 60°  
      B) 0°  
      C) 90°  
      D) 30°
   iv) The expression of 3.\( \phi \) power equation in terms of phase values
      A) \( 3 V_{ph} I_{ph} \sin \phi \)  
      B) \( \sqrt{3} V_{ph} I_{ph} \cos \phi \)  
      C) \( 3 V_{ph} I_{ph} \cos \phi \)  
      D) \( \sqrt{3} V_{ph} I_{ph} \sin \phi \)

b. With relevant vector diagram, show that two wattmeters are sufficient to measure three-phase power. (08 Marks)

c. Three equal impedances, each having a resistance of 8\( \Omega \) and inductive reactance of 6\( \Omega \) are connected in i) Star; ii) Delta, across a 3-phase, 440V supply. Find:
   i) Phase current
   ii) Line current
   iii) Total power consumed by the circuit in both cases. (08 Marks)

4 a. Choose your answers for the following: (04 Marks)
   i) The number of revolution of the disc in energy meter is directly proportional to the consumed
      A) power  
      B) energy  
      C) voltage  
      D) current
   ii) Integrating meters are used for the measurement of
      A) current  
      B) voltage  
      C) power  
      D) energy
   iii) In a dynamometer wattmeter, the moving coil is
      A) potential coil  
      B) current coil  
      C) current or potential coil  
      D) none of these
   iv) A good earthing should provide _____ resistance in earthing path
      A) medium  
      B) high  
      C) low  
      D) none of these

b. Explain with a neat diagram the working of dynamometer type wattmeter. (08 Marks)
c. With a neat diagram explain plate earthing. (04 Marks)
d. Define the following terms with reference to fuses:
   i) Rated current
   ii) Fusing current
   iii) Fusing factor. (04 Marks)
PART – B

5 a. Choose your answers for the following: (04 Marks)
   i) The commutator converts in the dc machine
      A) ac to ac
      B) dc to ac
      C) ac to dc
      D) dc to dc
   ii) The direction of the force in Dc motor is given by
      A) Fleming’s left hand rule
      B) Fleming’s right hand rule
      C) Lenz’s law
      D) Cork screw rule
   iii) Electrical equivalent of the mechanical power developed by the armature is equal to
      A) \( V_a I_a \)
      B) \( E_b I_a \)
      C) \( I_a^2 R_a \)
      D) none of these
   iv) For DC series motor, torque is proportional to
      A) \( I_a^2 \)
      B) \( I_a \)
      C) \( V^2 \)
      D) none of these

b. With a neat sketch, explain the construction of the DC machine showing the various parts. (06 Marks)
c. Give the classification of DC motor, sketch the various characteristics of shunt and series motor and mention their applications. (06 Marks)
d. A 4 pole, 500V shunt motor has 720 conductors wave connected on its armature, the full load armature current is 60A and the flux per pole is 0.03 wb. The armature resistance is 0.2\( \Omega \) and the contact drop is 1V per brush. Calculate the full load speed. (04 Marks)

6 a. Choose your answers for the following: (04 Marks)
   i) The core of the transformer is laminated to reduce
      A) friction loss
      B) copper loss
      C) hysteresis loss
      D) eddy current loss
   ii) The iron losses depend on the maximum value of the
      A) input voltage
      B) input current
      C) flux density
      D) frequency
   iii) If copper loss of a transformer at 1/2 full load is 200 watts then its full load copper loss would be
      A) 200 W
      B) 400 W
      C) 1600 W
      D) 800 W
   iv) The copper losses in the transformer vary as the square of the
      A) voltage
      B) power
      C) flux density
      D) current

b. Derive an expression for the electromotive force induced in the secondary winding of a transformer. (05 Marks)
c. Define the efficiency of a transformer and derive the condition for which the efficiency of a transformer is maximum. (05 Marks)
d. A 600 KVA transformer has an efficiency of 92% at full load unity p.f. and half load, 0.9 p.f. Determine its efficiency at 75% of full load and 0.9 p.f. (06 Marks)
7 a. Choose your answers for the following:
   i) A 6 pole, 1000 rpm alternator generates emf at a frequency of
      A) 60 Hz  
      B) 40 Hz  
      C) 25 Hz  
      D) 50 Hz
   ii) A smooth cylindrical type rotor is used for alternator having
      A) low speed 
      B) low and medium speed 
      C) high speed 
      D) none of these
   iii) For full pitch coil, the pitch factor Kp is
      A) less than 1 
      B) 1  
      C) greater than 1 
      D) none of these
   iv) The number of cycles generated in a 8-pole alternator in one revolution is
      A) 4  
      B) 2 
      C) 8  
      D) 16 

b. Obtain expression for emf of an alternator and explain the significance of winding factor. 

(06 Marks)

c. How are alternators classified? With neat figures, give the constructional difference between them.

(05 Marks)

d. A 6 pole, three phase star connected alternator has an armature with 90 slots and 8 conductors per slot and rotates at 1000 rpm. The flux per pole is 0.05 wb. Calculate the emf generated, if the winding factor is 0.97 and pitch factor is unity.

(05 Marks)

8 a. Choose your answers for the following:
   i) In three-phase IM a rotating magnetic field of constant magnitude
      A) \( \frac{\sqrt{3}}{2} \phi_m \)  
      B) 1.5 \( \phi_m \)  
      C) \( -\frac{\sqrt{3}}{2} \phi_m \)  
      D) -1.5 \( \phi_m \)
   ii) A 4 pole, 50Hz induction motor runs with a slip of 4%. What is the speed of motor?
      A) 1500 rpm  
      B) 1400 rpm  
      C) 1440 rpm  
      D) 1000 rpm
   iii) An induction motor under full load has a slip of about
      A) 0.03  
      B) 0.3  
      C) 0.1  
      D) zero
   iv) The frequency of rotor induced current is given by
      A) \( f' = \frac{f}{s} \)  
      B) \( f' = sf \)  
      C) \( f' = \sqrt{s}f \)  
      D) \( f' = (1 - s) f \)

b. Explain the concept of rotating magnetic field in an 3φ induction motor.

(06 Marks)

c. Define a slip. Derive expression for the slip and frequency of rotor current.

(05 Marks)

d. A 3-phase induction motor has 6 poles and runs at 960 rpm on full load. It is supplied from an alternator having 4 poles and running at 1500 rpm. Calculate the full load slip and the frequency of the rotor currents of the induction motor.

(05 Marks)

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First/Second Semester B.E. Degree Examination, May/June 2010

Basic Electrical Engineering

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing at least two questions 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.

PART - A

1. a. Choose the correct answer from the following:
   i) A wire of resistance R is stretched to double its length. The new resistance of the wire is ________.
      A) \( \frac{R}{2} \)  B) 2R  C) 4R  D) \( \frac{R}{4} \)
   ii) The Fig.Q1(a)(ii) shows a part of a closed electrical circuit. The potential drop between A and B is ________.
       A) 18 V  B) -18 V  C) 4 V  D) -4 V

   ![Fig.Q1(a)(ii)]

   iii) AT/m is the unit of ________
       A) m.m.f.  B) Reluctance  C) Magnetizing force  D) Magnetic flux density.
   iv) The e.m.f. induced in a coil of N turns is ________.
       A) \( N \frac{d\phi}{dt} \)  B) \( N \frac{d\phi}{di} \)  C) \( -N \frac{d\phi}{dt} \)  D) \( L \frac{d\phi}{dt} \)

1 (04 Marks)

b. The total power consumed by the network shown in Fig.Q1(b) is 16 W. Find the value of R and the total current.

![Fig.Q1(b)]

1 (06 Marks)

c. Define the coefficient of coupling and find its relation with \( L_1 \), \( L_2 \) and \( M \).
1 (04 Marks)

d. Two identical coils of 1200 turns each, are placed side by side such that, 60% of the flux produced by one coil links the other. A current of 10 A in the first coil, sets up a flux of 0.12 mwb. If the current in the first coil changes from +10 A to -10 A in 20 msec, find:
   i) The self inductance of the coils  ii) The e.m.f.s induced in both the coils.
1 (06 Marks)
2 a. Choose the correct answer from the following:
   i) An alternating voltage is given by \( V = 100 \sin (314 t - 30^\circ) \) volts. The frequency is ______.
      A) 25 Hz    B) 50 Hz    C) 60 Hz    D) 100 Hz
   ii) The peak factor of a sinusoidally varying voltage is ______.
        A) 1.414    B) 1.11    C) 0.866    D) 0.707
   iii) The p.f. is lagging when ______.
         A) Voltage lags the current    B) Current lags the voltage
         C) Voltage lags the power    D) Current lags the power.
   iv) The reactive power in a single phase a.c. circuit is given by ______.
        A) \( E \cos \phi \)    B) \( E \sin \phi \)    C) \( EI \)    D) None of these (04 Marks)

b. Show that a pure capacitance does not consume any power. Draw the waveforms of voltage, current and power, when alternating voltage is applied to the pure capacitance circuit. (08 Marks)

c. A coil of power factor 0.6 is in series with a 100 \( \mu \)F capacitor. When connected to a 50 Hz supply, the p.d. across the coil is equal to the p.d. across the capacitor. Find the resistance and inductance of the coil. (08 Marks)

3 a. Choose the correct answer from the following:
   i) In a three phase balanced supply system, the sum of the instantaneous values of the three voltages at any instant is ______.
      A) Maximum    B) Zero    C) Minimum    D) None of these
   ii) In a three phase balanced star system, the relation between the line voltage \( V_L \) and the phase voltage \( V_{ph} \) is ______.
      A) \( V_L = \frac{V_{ph}}{\sqrt{3}} \)    B) \( V_L = \sqrt{3} V_{ph} \)    C) \( V_L = V_{ph} \)    D) None of these
   iii) The voltage \( V_{AB} = 50[30^\circ] \) volts. Then, \( V_{BA} \) is ______ volts.
      A) 50 \(-180^\circ\)    B) 50 \(-150^\circ\)    C) 50 \(-30^\circ\)    D) 50 \(-210^\circ\)
   iv) When the two wattmeters used to measure a three phase power, give equal readings, then the p.f. of the circuit is ______.
      A) 0.5    B) 0    C) 0.866    D) 1 (04 Marks)

b. For a three phase star connection, find the relation between live and phase values of currents and voltages. Also derive the equation for the three phase power. (05 Marks)

c. Explain the effect of power factor on the two wattmeter readings connected to measure the three phase power. (05 Marks)

d. Three similar coils each having resistance of 10 \( \Omega \) and reactance of 8 \( \Omega \) are connected in star across a 400 V, 3 phase supply. Determine the:
   i) Line current
   ii) Total power and
   iii) Reading of each of the two wattmeters connected to measure the power. (06 Marks)

4 a. Choose the correct answer from the following:
   i) The dynamometer type wattmeter is used to measure ______.
      A) Only D.C. power    B) Only A.C. power
      C) Both D.C. and A.C power    D) Both active and reactive power
   ii) The pointer in the dynamometer type wattmeter is made of ______.
      A) Copper    B) Aluminum    C) Phosphor bronze    D) Platinum
   iii) One unit of electrical energy is equivalent to ______.
      A) 1 KWH    B) 3600 W-sec    C) 100 WH    D) 10 KWH
   iv) In the energy meter, constant speed of rotation of the disc is provided by ______.
      A) Shunt magnet    B) Series magnet
      C) Braking magnet    D) None of these (04 Marks)
4. With a neat diagram, explain the working of 1-phase energy meter.  
   c. Explain the necessity of earthing. Explain pipe earthing, with a neat diagram.  

   **PART – B**

   5. a. Choose the correct answer from the following:
      
      i) The armature of a d.c. generator is laminated to reduce 
         
         A) Eddy current loss  B) Hysteresis loss  
         C) Friction loss  D) Copper loss
         
      ii) In a wave winding, the number of parallel paths is equal to 
         
         A) \( \frac{p}{2} \)  B) 2  C) \( p \)  D) 2p
         
      iii) The d.c. motor equation is 
         
         A) \( V = E_b + I_a R_a \)  B) \( V = E_b - I_a R_a \) 
         C) \( E_b = I_a R_a - V \)  D) None of these
         
      iv) For the movement of a train d.c. motors are used.
         
         A) Shunt  B) Series  
         C) Compound  D) None of these
         
   b. With a neat sketch, explain the constructional features of a D.C. machine. Mention the functions of each part.

   c. A 440 V dc shunt motor takes an armature current of 20 A and runs at 500 rpm. The armature resistance is 0.6 ohm. If the flux is reduced by 30% and the torque is increased by 40%, calculate the new values of armature current and speed.

   6. a. Choose the correct answer from the following:
      
      i) An ideal transformer does not change 
         
         A) Voltage  B) Current  C) Power  D) None of these
         
      ii) In a step-up transformer remains constant. 
         
         A) Voltage  B) Current  C) Power  D) None of these
         
      iii) Transformation ratio in a transformer is equal to 
         
         A) \( \frac{E_1}{E_2} \)  B) \( \frac{N_1}{N_2} \)  
         C) \( \frac{N_2}{N_1} \)  D) \( \frac{I_2}{I_1} \)
         
      iv) A transformer has 200 W iron loss at full load. The iron loss at half full load is 
         
         A) 100 W  B) 200 W  C) 400 W  D) 300 W
         
   b. Explain the working principle of a transformer on load.

   c. What are the various losses that occur in a transformer? Give the equations for these losses.

   d. A 600 KVA transformer has an efficiency of 92% at full load and unity p.f. The p.f. is 0.9 at half load. Determine its efficiency at 75% of full load and 0.9 p.f.

    **7. a.** Choose the correct answer from the following:
      
      i) A salient pole rotor is used in 
         
         A) Low speed  B) Medium speed  C) High speed  D) At all speeds
         
      ii) The number of cycles of emf generated in a 4 pole alternator per revolution is 
         
         A) 4  B) 2  C) 50  D) 100
         
      iii) An 8 pole alternator runs at 600 rpm. The frequency of the induced emf is 
         
         A) 40 Hz  B) 50 Hz  C) 60 Hz  D) 70 Hz
         
      iv) When an alternator is loaded, its terminal voltage 
         
         A) Increases  B) Decreases  C) Does not change  D) None of these
         
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7. b. How are alternators classified? With neat figures, give the constructional difference between them. 
(04 Marks)
c. Obtain the expression for emf of an alternator and give the significance of the winding factor. 
(06 Marks)
d. A two pole, three phase alternator running at 3000 rpm has 42 armature slots with two conductors in each slot. Calculate the flux per pole, required to generate a live voltage of 2300 V. Distribution factor is 0.952 and the pitch factor is 0.956. 
(06 Marks)

8. a. Choose the correct answer from the following:
   i) When a 3-ϕ supply is given to the stator of a 3-ϕ induction motor, a ______ magnetic field is produced.
      A) Stationary   B) Alternating   C) Rotating   D) None of these
   ii) In a 3-ϕ induction motor, the slip speed is given by ______.
      A) N_s   B) N   C) N_s - N   D) N - N_s
   iii) A supply of 50 Hz is given to a 3-ϕ I.M having 4 poles. If the I.M runs at 1440 rpm, the slip is ______.
      A) 3%   B) 4%   C) 5%   D) 3.33%
   iv) The air-gap between the stator and the rotor of a 3-ϕ I.M ranges from ______.
      A) 2 cm to 4 cm   B) 0.4 mm to 4 mm
      C) 1 cm to 2 cm   D) 4 cm to 6 cm
   (04 Marks)
b. What is slip in an induction motor? Explain why slip is never zero in an induction motor. 
(06 Marks)
c. Explain why an induction motor needs a starter. 
(04 Marks)
d. A 6 pole induction motor is supplied by a 10 pole alternator which is driven at 600 rpm. If the motor is running at 970 rpm, determine the percentage slip. 
(06 Marks)
PART – A

1. a) A series circuit consists of 4.7KΩ, 5.6KΩ, 9KΩ and 10KΩ resistors, which resistor has the most voltage across it?
   A) 4.7KΩ B) 5.6KΩ C) 9KΩ D) 10KΩ
   i) The power dissipation in each of three parallel branches is 1W. The total power dissipation of the circuit is
   A) 1W B) 4W C) 3W D) 9W
   ii) The direction of induced emf in a conductor can be deduced by
   A) Fleming’s Left Hand rule B) Fleming’s Right Hand rule
   C) Cork screw rule D) Lenz’s law.
   iii) The maximum value of coefficient of coupling is
   A) 100% B) more than 100% C) 90% D) none of these
   b. Obtain the potential difference $V_{xy}$ in the circuit of fig.Q1(b).

   ![Diagram](image)

   Fig.Q1(b)

   c. Derive an expression for energy stored in the magnetic field.
   d. Define coefficient of coupling and establish relation between self inductance, mutual inductance with coefficient of coupling.

2. a) i) The time period of a sinusoidal wave form with 200Hz frequency is
   A) 0.05S B) 0.005S C) 0.0005S D) 0.5S
   ii) The peak value of a sine wave is 400V, its average value is
   A) 254.6V B) 282.6V C) 400V D) 565.5V
   iii) In a certain RL circuit, $V_R = 2V$ and $V_L = 3V$. The magnitude of total voltage is
   A) 2V B) 3V C) 5V D) 3.6V
   iv) When the frequency of the applied voltage in series RC circuit is increased the capacitance reactance
   A) increase B) decreases C) becomes zero D) remains same

1 of 4
b. Define i) form factor and ii) power factor in ac circuits. (04 Marks)
c. Obtain the form factor of full rectified sine wave. (05 Marks)
d. When 220V AC supply is applied across AB terminals in the circuit shown in fig. Q2(d), the total power input is 3.25KW and the current is 20amps. Find the current through \( Z_3 \). (07 Marks)

\[ Z_2 = 5 + j \omega \]
\[ Z_4 = 5 + j \omega \]

Fig. Q2(d)

3 a. i) In a balanced three phase load, the power factor of the three phases are ______.
   A) different  B) same  C) zero  D) none of these.

ii) The power taken by a 3-phase load is given by the expression ______.
   A) \( 3V_l \, I_l \, \cos \phi \)  B) \( \sqrt{3} \, V_l \, I_l \, \cos \phi \)  C) \( 3V_l \, I_l \, \sin \phi \)  D) \( \sqrt{3} \, V_l \, I_l \, \sin \phi \)

iii) In the 2 wattmeter method of measuring 3-phase power, the two wattmeters indicate equal and opposite readings when the load power factor angle is ______ degrees lagging.
   A) 60  B) 0  C) 30  D) 90

iv) In delta connected system, the relation between the line current \( I_l \) and phase current \( I_{ph} \) is ______.
   A) \( I_l = I_{ph} \)  B) \( I_l = I_{ph} / \sqrt{3} \)  C) \( I_l = \sqrt{3} \, I_{ph} \)  D) \( I_l = 3 \, I_{ph} \). (04 Marks)

b. Obtain the relationship between the phase and line values of voltages and currents in a balanced star connected system. (08 Marks)

c. A balanced three phase star connected load draws power from 440V supply. The two wattmeters connected indicate \( W_1 = 5 \text{KW} \) and \( W_2 = 1.2 \text{KW} \). Calculate power, power factor and current in the circuit. (08 Marks)

4 a. i) A fuse is a ______.
   A) current limiting device  B) protective device  C) voltage limiting device  D) None of these.

ii) A good earthing should provide ______ resistance in earthing path.
   A) low  B) high  C) medium  D) none of these.

iii) In the energy meter, constant speed of rotation of disc is provided by ______.
   A) shunt magnet  B) series magnet  C) braking magnet  D) none of these.

iv) In the measuring instruments, under equilibrium condition, controlling torque \( (T_c) \) and deflecting torque \( (T_d) \) are ______.
   A) \( T_c = T_d \)  B) \( T_c > T_d \)  C) \( T_c < T_d \)  D) None of these. (04 Marks)

b. Explain with neat diagram working of induction type energy meter. (08 Marks)

c. Why earthing of electrical apparatus is required? Explain. (04 Marks)

d. What is the purpose of fuse? What are the requirements of good fuse? (04 Marks)
PART – B

5 a. i) The material for commutator brushes is always ________
   A) mica       B) copper       C) cast iron     D) carbon
   ii) Which DC motor will be preferred for constant speed line shafting ________
   A) cumulatively compound motor  B) differentially compound motor
   C) shunt motor                  D) series motor.
   iii) For a 'P' pole lap wound armature of DC machine the number of parallel paths are equal to ________
         A) 2        B) 2P        C) P          D) P/2.
   iv) The relationship between the applied voltage and back emf in DC motors is ________
         A) \( V = E_b + I_aR_a \)   B) \( V = E_b - I_aR_a \)
         C) \( V = E_r \)           D) none of these.

   (04 Marks)

b. Why starter is needed? With neat sketch, explain 3 – point starter used for DC motor.

   (08 Marks)

c. A DC series motor is running with a speed of 1000 rpm, while taking a current of 22 amps from the supply. If the load is changed such that the current drawn by the motor is increased to 55amps, calculate the speed of the motor on new load. The armature and series winding resistances are 0.3Ω and 0.4Ω respectively. Assume supply voltage as 250V.

   (08 Marks)

6 a. i) Losses which donot occur in transformer are ________
       A) copper losses  B) magnetic losses  C) friction losses  D) none of these
   ii) If Copper loss of a transformer at 1/4th full load is 100W, then its full load copper loss would be ________
        A) 100W        B) 400W        C) 800W        D) 1600W.
   iii) If an ammeter in the secondary of a 100/10V transformer reads 10A, the current in the primary would be ________
        A) 1A         B) 2A         C) 10A        D) 100A
   iv) The no load primary current \( I_0 \) in transformer ________
        A) is in phase with \( V_1 \)  B) leads \( V_1 \) by \( 90^\circ \)  C) lags behind \( V_1 \) by \( 90^\circ \)
        D) lags \( V_1 \) by an angle between \( 0^\circ \) and \( 90^\circ \).

   (04 Marks)

b. Explain with vector diagram the working principle of transformer on no – load. (06 Marks)

c. Define the voltage regulation of transformer; what is its importance? (04 Marks)

d. The primary winding of a transformer is connected to a 240V, 50Hz supply. The secondary winding has 1500 turns. If the maximum value of the core flux is 0.00207 Wb, determine i) the secondary induced emf  ii) number of turns in the primary  iii) cross sectional area of core if the flux density has maximum value of 0.465 Tesla.

   (06 Marks)

7 a. i) The field winding of an alternator is excited by ________
        A) dc        B) ac       C) both dc and ac     D) none of these.
   ii) For full pitch coil, the pitch factor \( K_p \) is ________
        A) 1        B) greater than 1    C) less than 1     D) none of these.
   iii) The number of cycles generated in a 6-pole alternator in one revolution is ________
        A) 2          B) 6        C) 50       D) none of these.
   iv) The non salient pole field construction is used for ________ alternator.
        A) low speed      B) medium speed    C) high speed     D) none of these.

   (04 Marks)

b. Enumerate the advantages of having stationary armature and rotating field system in large size alternator.

   (08 Marks)
c. A 3-phase, 50Hz, 16 pole alternator with star connected winding has 144 slots with 10 conductors/slot. The flux per pole 24.8m Wb is sinusoidally distributed, the coils are full pitched. Find i) speed and ii) the line emf. Assume winding factor $K_d = 0.96$. (08 Marks)

8 a. i) The relation between rotor frequency ($f'$) and stator frequency ($f$) is given by

A) $f' = sf$  B) $f' = f/s$  C) $f' = \sqrt{sf}$  D) $f' = (1 - s) f$.

ii) Synchronous speed of three phase induction motor is given by

A) $N_s = 120 \text{ f}p$  B) $N_s = 120 \text{ f}/p$  C) $N_s = 120 \text{ f}/p$  D) $N_s = \text{fp}/120$.

iii) The frame of induction motor is usually made of

A) silicon steel  B) cast iron  C) aluminium  D) bronze.

iv) A 4 pole, 440V, 50Hz induction motor is running at a slip 4%. The speed of motor is

A) 1260 rpm  B) 1440 rpm  C) 1500 rpm  D) 1560 rpm. (04 Marks)

b. What is ‘slip’ in an induction motor? Explain why slip is never zero in an induction motor. (06 Marks)

c. What are the applications of 3-phase induction motors? (04 Marks)

d. If the electromotive force in the stator of an 8-pole induction motor has a frequency of 50Hz and that in the rotor 1.5Hz, at what speed is the motor running and what is the slip? (06 Marks)