



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH (OLD)/SEM-2/EE-201/2011

2011

BASIC ELECTRICAL ENGINEERING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :
 $10 \times 1 = 10$
 - i) Thevenin's theorem can be applied to networks containing
 - a) passive elements only b) active elements only
 - c) linear elements only d) all of these.
 - ii) The number of circuits required to solve a network using superposition theorem is equal to the number of
 - a) nodes
 - b) branches
 - c) voltage sources
 - d) voltage plus current sources.

- 2



- vii) In a transformer, which of the following can not be classified as core loss ?
- a) Hysteresis loss
 - b) Eddy current loss
 - c) Copper loss due to current in the windings
 - d) All of these.
- viii) What is done to balance the *mmf* setup due to the secondary current ?
- a) The primary voltage is increased
 - b) The core flux is increased immediately
 - c) The current in the primary is increased
 - d) All of these.
- ix) Which of the following types of winding is used for the stator of a three - phase induction motor ?
- a) Lap winding
 - b) Wave winding
 - c) distributed a.c. star/delta connected
 - d) concentrated.
- x) In the star-delta starter the voltage applied across the stator winding is
- a) equal to the supply voltage
 - b) $\sqrt{3}$ times the supply voltage
 - c) $1/\sqrt{3}$ time the supply voltage
 - d) $2/\sqrt{3}$ times the supply voltage.



- xi) The flux produced by the field winding in a d.c. machine
- a) rotates at a synchronous speed with respect to the stator
 - b) rotates at a speed less than the synchronous speed with respect to the stator
 - c) rotates at a speed higher than the synchronous speed with respect to stator.
 - d) is stationary with respect to stator.
- xii) When compared with an electric circuit which of the following parameters in a magnetic circuit are analogous ?
- a) Current & flux
 - b) Electric field strength & magnetic field strength
 - c) Voltage drop & *mmf* drop
 - d) All of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Define the following terms.
- a) Electric flux
 - b) Electric flux density
 - c) Electric potential
 - d) Electric potential difference
 - e) Dielectric strength.



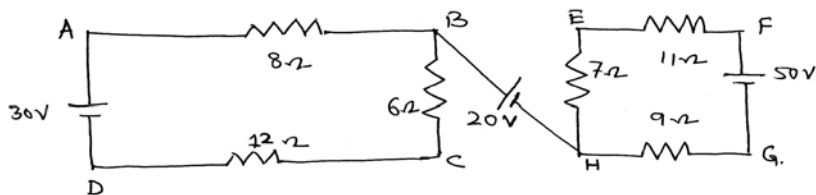
3. Define average value of alternating quantity & derive its expression for sinusoidal current.
4. Define the efficiency & voltage regulation of a transformer at a given load.
5. Derive the relationship between the line current & phase current, line voltage & phase voltage for a balanced three phase star connected inductive load connected across three phase supply.
6. Explain the principle of operation of a three - phase induction motor.

GROUP - C

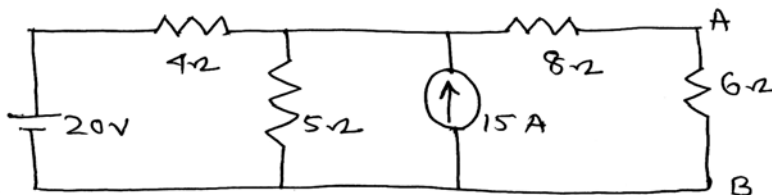
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Find V_{DF} & V_{AG} for the following circuit :



- b) Apply the Thevenin's theorem to calculate current flowing through the AB branch for the following circuit :



7 + 8



8. a) A 50 Hz, sinusoidal voltage applied to a single phase circuit has RMS value of 200V. Its value at $t = 0$ is $200\sqrt{2}$ volt positive. The current drawn by the circuit is 5 amp (RMS) & lags behind the voltage by one sixth of a cycle. Write the expression for the instantaneous value of voltage & current. Sketch their waveforms.
- b) Two circuits A & B are connected in parallel to a 115V, 50 HZ supply. The total current taken by the combination is 10 amp at unity power factor. Circuit A consists of 10Ω resistance & 200×10^{-6} F capacitor connected in series. Circuit B consists of a resistance & an inductance in series. Determine the following data for circuit B : (i) current (ii) power factor (iii) impedance and (iv) resistance. 5 + 10
9. a) A 55 kVA single phase transformer has primary winding of 460 turns & secondary winding of 160 turns. The input side of transformer is supplied with voltage of 2500V, 50 Hz supply. Calculate secondary voltage, primary & secondary full load current & maximum value of flux.
- b) The following is the test data for a 50 kVA, 1100/110V transformer : OC test performed on the 110V side : 110V, 1.0A, 100W.
- SC test performed on the 1100V side : 80V, full load current, 800W. Draw the equivalent circuit of the transformer referred to high voltage side. 5 + 10
10. A balanced star connected load is supplied from a symmetrical three-phase 400V & 50 Hz system. The current



in each phase is 30 amp & lags 30° behind the phase voltages. Find : (i) Phase voltage (ii) Resistance & reactance per phase (iii) load inductance per phase (iv) total power consumed (v) Reactive volt ampere (vi) total volt amp. Draw the phasor diagram showing the current & voltage. 15

11. a) Deduce & explain the speed torque characteristics of shunt & series motors.
- b) A shunt machine, connected to a 200V mains, has an armature resistance (including brushes) of 0.15Ω & the resistance of the field circuit is 100Ω . Find the ratio of its speed as a generator to its speed as a motor, the line current in each case being 75A. 8 + 7
12. a) An iron ring has its mean length of flux path as 60 cm, its cross-sectional area as 15 cm^2 & its relative permeability is 500. Find the current required to be passed through the coil of 300 turns wound uniformly around it, to produce a flux density of 1.2T. What would be the flux density with the same current, if the iron ring is replaced by an air core ?
- b) Two identical coils are P & Q , each with 1500 turns are placed in parallel planes near each other, so that 70% of the flux produced by current in the coil P links with coil Q . If a current of 4A is passed through any one coil, it produces a flux of 0.04 m Wb linking with itself. Find the self inductance of the two coils, the mutual inductance & co-efficient of coupling between them.

8 + 7