Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.TECH(O)/SEM-1/EE-101/2012-13
2012
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 the following :

                                                        10 × 1 = 10

   i)   Inductive reactance of a coil of inductance 0.2 H at 50 Hz is

        a)   62.8 ohms   b)   628 ohms

        c)   0.2 ohm   d)   20 ohms.

   ii) In a 3 phase system, the *emfs* are

        a)   30˚ apart   b)   60˚ apart

        c)   90˚ apart   d)   120˚ apart.

   iii) The commutator of a d.c. machine acts as a

        a)   full-wave rectifier

        b)   half-wave rectifier

        c)   controlled full-wave rectifier

        d)   none of these.

1252(O)   [Turn over

iv) Part percentage of the maximum power is delivered to a load if load resistance is 10 times greater than the Thevenin resistance of the source to which it is connected ?

a) 25%

b) 40%

c) 35·39%

d) 33·06%.

v) Hysteresis loss in a transformer can be reduced by using

a) Laminated Core

b) Silicon Steel Core

c) Oil

d) None of these.

vi) The capacitance of a capacitor is not influenced by

a) plate thickness

b) plate separation

c) plate area

d) nature of dielectrics.

vii) The three-phase slip-ring induction motor has

a) short-circuited rotor

b) double cage rotor

c) wound rotor

d) none of these.

viii) The direction of rotation of a *d.c.* shunt motor can be reversed by interchanging its

a) supply terminals

b) shunt-field resistance

c) shunt and armature terminals together

d) none of these.

ix) Hysteresis loss in a transformer can be reduced by using

a) laminated core

b) silicon-steel core

c) oil

d) none of these.

x) The time constant of a series R-C circuit is

a) R/C

b) C/R

c) RC

d) $\dfrac{1}{RC}$.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. Draw the speed-torque characteristics of *d.c.* series motor and explain.

3. Derive an experssion of the following :
    a) average
    b) r.m.s. value of a half-wave rectified voltage wave.

4. State and prove Ampere's circuital law.

5. Define self and mutual inductance. What do you mean by co-efficient of coupling ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

6. a) Deduce the e.m.f. equation of d.c. generator.

    b) A 4-pole, 220 V d.c. shunt motor has armatrue and shunt field resistance of 0.2 and 220 ohms respectively. It taken 20 A at 220 V from the source while running at a speed of 1000 r.p.m. Find
        i) field current
        ii) armature current
        iii) back emf
        iv) torque developed.   6 + 9

7. A 75 kVA transformer has 500 turns primary and 100 turns secondary. The primary and secondary resistances are 0.4 ohm and 0.02 ohm respectively and the corresponding leakage reactances are 1.5 ohms and 0.045 ohms respectively. The supply voltage is 2200 volts. Calculate

    a) The equivalent impedance referred to the primary

    b) The voltage regulation at power factor of 0·8 lagging.

                                        5 + 10
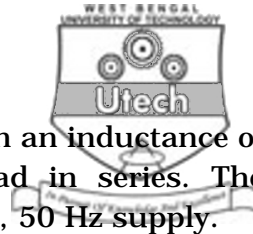
8. A resistance of 100 ohms is connected with an inductance of 1·2 Henry and capacitance of microfarad in series. The combination is connected across 100 volts, 50 Hz supply.
Find

a) Current in the resistance

b) Voltage across the capacitance

c) Power consumed.

Draw phasor diagram. 10 + 5

9. a) Explain how a rotating magnetic field is produced in a 3 phase induction motor.

b) A 3 phase, 6 pole, 50 Hz Induction Motor has a slip of 1% at no load and 3% at full load.
Calculate

i) synchronous speed

ii) no load speed

iii) full load speed

iv) frequency of rotor current full load

v) frequency of rotor current of stand still.

c) Explain with suitable diagram a method of controlling speed of an induction motor. 5 + 5 + 5

10. a) Why is a 3-phase induction motor self-starting ?

b) A 4-pole, 3-phase, 275 kW, 440 V, 50 Hz induction motor is running with a slip of 4%. Find (i) synchronous speed (ii) rotor speed (iii) frequency of rotor induced *emf*. Deduce all formulae used.

c) Discuss different methods of starting of a three-phase induction motor. 5 + 5 + 5

11. a) Derive the expression for *emf* in a DC generator.

b) Write a short note on back *emf*.

c) A 4-pole shunt generator supplies 80A at a terminal voltage of 400 V. If armature resistance is 0·04 ohm and shunt-field resistance is 80 ohms, find generated *emf*. Take voltage drop per brush as 1 volt. 6 + 2 + 7