*Name* : .....

*Roll No.* : .....

*Invigilator's Signature :* .....

**CS / B.TECH (OLD) / SEM-1 / EE-101 / 2010-11**

# 2010-11

# 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) The capacitance of a capacitor is not influenced by

a) plate separator b) plate thickness

c) plate area d) nature of dielectric.

ii) The efficiency of a circuit under maximum power transfer condition is

a) 50 % b) 25 %

c) 75 % d) 100 %.

iii) Battery is an example of

a) voltage dependent voltage source

b) current dependent voltage source

c) independent voltage source

d) independent current source.

iv) The efficiency of a transformer is maximum when

a) Cu losses are zero

b) Iron losses are zero

c) Cu losses are 50% of iron losses

d) Cu losses are equal to iron losses.

v) For additive flux of two coils connected in series, the equivalent inductance can be expressed as

a) $L_1 + L_2$ b) $L_1 + L_2 + 2M$

c) $L_1 + L_2 - 2M$ d) $L_1 + L_2 + M$ .

vi) Resonant frequency *fr* of a series RLC circuit is related to half-power frequencies $f_1$ and $f_2$ as

a) $fr = \frac{f_1 + f_2}{2}$ b) $fr = \sqrt{f_1 f_2}$

c) $fr = f_2 - f_1$ d) $fr = \sqrt{f_1} + \sqrt{f_2}$ .

vii) In the circuit shown in figure, if the power consumed by $5\Omega$ resistor is 10 W, then power factor of the circuit is

a) 0·8 b) 0·6

c) 0·5 d) zero.

viii) For a wave connected *dc* machine, number of poles is 6. The number of parallel path is

a) 4 b) 8

c) 6 d) none of these.

ix) The *dc* motor needs a starter during starting to control

a) speed b) current

c) voltage d) flux.

x) The *emf* induced in the rotor of an induction motor has frequency

a) same as supply frequency

b) same as slip frequency

c) difference between supply & slip frequency

d) none of these.

xi) The commutator of a *dc* machine acts as a

a) full-wave rectifier

b) half-wave rectifier

c) controlled full-wave rectifier

d) contact.

xii) The normal efficiency of a transformer is

a) 10% b) 50%

c) 75% d) 95%.

## GROUP – B

### ( Short Answer Type Questions )

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

2. Derive the torque equation of a *dc* motor.

3. Explain the principle of working of a 3 $\phi$ induction motor.

4. A voltmeter is connected to a source having voltage waveform given by $v = 20\sin wt + 10\sin 3wt + 5\sin 5wt$. If the voltmeter reads the *rms* value, find the reading of the voltmeter.

5. Explain the difference between statically & dynamically induced *emf*s. Give example.

6. Deduce an expression of electric field at a general point due to infinitely long charged conductor.

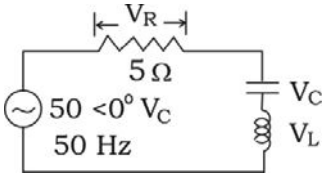
## GROUP – C

### ( Long Answer Type Questions )

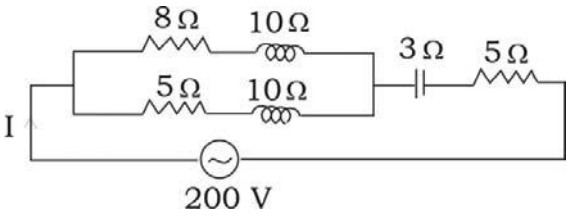
Answer any *three* of the following. $3 \times 15 = 45$

7. a) Why is a series resonant circuit called an acceptor circuit & parallel resonant circuit is called rejecter circuit ?

b) In the circuit diagram shown, the magnitude of $V_L$ and $V_C$ are twice that of $V_R$. Find the inductance of the coil.




c) For the circuit diagram shown below, find the current I.




3 + 5 + 7

8. a) Draw the phasor diagram of a single phase transformer for lagging power factor load.

b) The open circuit & short circuit test data of a 5 kVA, 200 / 400 volt, 50 Hz single phase transformer are

OC test : Primary voltage = 200 volts, I = 0·75 A,

W = 75 W.

SC test : Primary voltage = 18 volts, Current on

Secondary side = 12·5 A, W = 200 W.

Find the parameters of the equivalent circuit & draw the equivalent circuit w.r.t. primary side. 5 + 10

9. a) Deduce the *e.m.f.* equation of a *dc* generator.

   b) A shunt generator delivers 50 kW at 250 V & 400 *rpm*. The armature resistance is 0·02 Ω and field resistance is 50 Ω. Calculate the speed of the machine when running on a shunt motor and taking 50 kW input at 250 V.

5 + 10

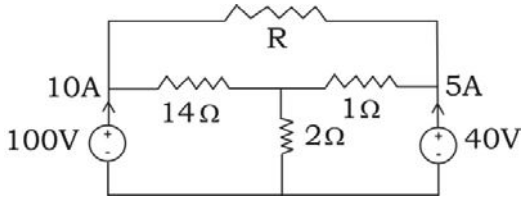
10. a) Define self & mutual inductance of coils.

    b) Two coils *A* of 1000 turns and *B* of 500 turns are mutually coupled with 80% coupling. If a current of 3*A* in *A* produces a flux of 0·25 m wb, find the mutual inductance and coefficient of coupling between the coils.

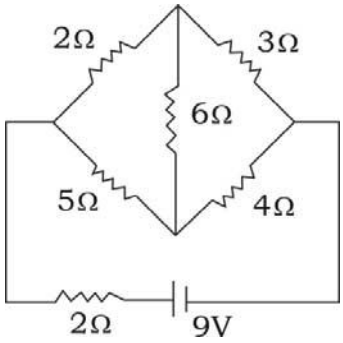
    c) A ring of mean diameter 30 cm is wound with 300 turns of copper wire carrying a current of 4*A*. The cross-section of the magnetic material of the ring is 12 $cm^2$ and its relative permeability is 2000. Determine the flux through it.

4 + 7 + 4

11. a) Find the value of R in the circuit shown below :



b) Calculate the current in the 6 Ω resistor in the circuit below using Thevenin's theorem :




7 + 8

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