	Utech
Name :	
Roll No.:	To State of Exemples 2nd Explored
Invigilator's Signature :	

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 :

 $10 \propto 1 = 10$

- i) In an a.c. circuit having R, L & C in series & operating on lagging p.f., increase in frequency will
 - a) reduce the current
 - b) increase the current
 - c) both (a) and (b) are possible
 - d) have no effect on current drawn.
- ii) KCL is a consquences of law of conservation of
 - a) energy

b) change

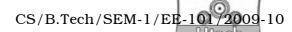
c) flux

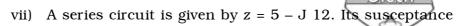
d) all of these.

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- iii) In a transformer, the resistance between the primary & secondary msut be
 - a) zero

- b) $1 \text{ k}\Omega$
- c) $100 \text{ k}\Omega$
- d) infinite.
- iv) The armature of a *d.c.* machine is laminated
 - a) to reduce the hysteresis losses
 - b) to reduce the eddy current losses
 - c) to ruduce the inductance of the armature
 - d) to reduce the mass of the armature.
- v) What will happen if the supply terminals of *d.c.* shunt motor are interchanged?
 - a) Motor will stop
 - b) The motor will run in the same original direction
 - c) The direction of rotation will reverse
 - d) Motor will run at a speed lower than the normal speed in the same direction.
- vi) The speed at which the rotating magnetic field produced by stator currents rotates is
 - a) synchronous speed
 - b) rotor speed
 - c) greater than synchronous speed
 - d) lower than synchronous speed.





is



b)
$$\frac{5}{169}$$

c)
$$\frac{12}{13}$$

d)
$$\frac{12}{169}$$
.

viii) The value of the resistance R_L for miximum power transfer will be

dia.

a)
$$5\Omega$$

b)
$$2\Omega$$

c)
$$6\Omega$$

d)
$$3\Omega$$
.

ix) The d.c. motor needs a starter during starting to control

x) In a 3-phase star connected system, the relation between the phase & line voltage is

a)
$$V_P = V_L$$

b)
$$V_P = \sqrt{3} V_L$$

c)
$$V_P = \frac{V_L}{\sqrt{3}}$$

d)
$$V_P = \frac{V_L}{3}$$
.

- xi) The force experienced by a small conductor of length l, carying current I, placed in a magnetic field B at an angle θ with respect to B is given by
 - a) BIl

- b) BIl $\sin \theta$
- c) BIl $\cos \theta$
- d) zero.
- xii) If a d.c. series motor is started on no-load, its speed will be
 - a) normal
- b) zero

- c) infinite
- d) below normal.

GROUP - B

(Short Answer Type Questions)

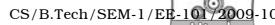
Answer any *three* of the following.

 $3 \propto 5 = 15$

2. State & prove Gauss' law.

- 5
- 3. a) What is the phasor relationship between the voltages $V_{\it RV}$ & $V_{\it RN}$ for a star connected circuit ?
 - b) Write down the expression for the instantaneous *emf* of a 3-phase system.
 - c) What are the various ways in which the three-phases of a 3-phase system can be properly connected?
 - d) How would you differentiate the energy consumed by a circuit from its power consumption ? 1 + 2 + 1 + 1

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4. The equation for a voltage wave is

 $v = 0.02 \sin (4000 t + 30^{\circ}).$

Find the frequency, the instantaneous voltage when $t=320~\mu$ sec. What is the time represented by 30° phase difference?

- 5. State & explain
 - a) Biot-Savart law
 - b) Ampere's circuital law.

5

6. Explain with the help of diagrams, how a rotating magnetic field is produced in the air-gap of a 3-phase induction motor.

GROUP - C

(Long Answer Type Questions)

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

- 7. a) The circuit shown in the figure is connected to a 230 V, 50 Hz supply. Find the value of
 - i) the current drawn
 - ii) voltages $V_1 \& V_2$
 - iii) power factor.

Draw a phasor diagram, indicating the terminal voltages \boldsymbol{V}_1 , \boldsymbol{V}_2 & the supply voltage with respect to current.

Dia.

b) Prove that the average power in an a.c. circuit is equal to $VI\cos\phi$. Explain the significance of $\cos\phi$ in the expression. 10+5

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- 8. a) Draw & explain the phasor diagram of transformer when it is operating under no-load.
 - b) A 5 kVA, 200 / 400 V, 50 Hz single-phase transformer gave the following results :

OC test : 200 V, 0.7 A, 60 W on *lv* side

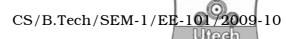
SC test : 22 V, 10 A, 120 W on hv side.

Determine the values of parameters of the equivalent circuit. 5 + 10

- 9. a) Why does the *d.c.* motor draw a very high current at starting, when started directly on line?
 - b) How can you control the speed of a *d.c.* motor in the lower range of speed which is less than its rated value?
 - c) A 4-pole *d.c.* shunt generator with lap connected armature supplies a load of 100 A at 200 V. The armature resistance is $0.1~\Omega$ & the shunt field resistance is 80 Ω . Find
 - i) total armature current
 - ii) current per armature path
 - iii) emf generated.

Assume a brush contact drop of 2 V.

3 + 5 + 7



- 10. a) Deduce an expression of energy stored in magnetic field.
 - b) An iron ring of mean length 60 cm has an air gap of 2 mm. It is wound with 300 turns of wire. If the relative permeability of iron is 300 when a current of 0.7 A flows through the coil. Find the flux density.

5 + 10

11. a) Solve the network shown in figure, for the current in the $8\ \Omega$ resistor by the following methods :

Dia.

- i) Superposition theorem
- ii) Thevenin's theorem.
- b) Three inductive coils, each with a resistance of 15 Ω & an inductance of 0.03 H are connected in star to 3-phase 400 V, 50 Hz supply. Calculate
 - i) Phase current & line current
 - ii) Total power absorbed. 10 + 5

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- 12. a) Define 'slip' of a 3-phase induction motor
 - b) Derive the relationship between the frequency of the rotor induced *emf* & the supply frequency to the stator.
 - c) Sketch & explain the torque-slip characteristics of a3-phase induction motor.
 - d) An 8-pole alternator runs at 750 rpm. It supplies power to a 6-pole, 3-phase induction motor, which has a full load slip of 3%. Find the full load speed of the induction motor & the frequency of its rotor *emf*.

2 + 3 + 3 + 7