



**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : ES-EE-101

PUID : 01009 (To be mentioned in the main answer script)

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 × 1 = 10
- i) The bandwidth of a series R-L-C circuit at resonance is given by
- a) $\frac{C}{2\pi L}$ b) $\frac{L}{2\pi R}$
- c) $\frac{R}{2\pi L}$ d) $\frac{C}{2\pi R}$
- ii) Transformer core is laminated to reduce
- a) copper loss b) hysteresis loss
- c) eddy current loss d) mechanical loss.
- iii) Power factor for AC resistive circuit is
- a) unity b) zero lagging
- c) zero leading d) none of these.
- iv) For R-L-C series resonance circuit, line current at resonance frequency is
- a) maximum b) minimum
- c) zero d) none of these.

- v) Two impedances $(10 + j10)\ \Omega$ and $(10 - j10)\ \Omega$ are connected in parallel. Their equivalent impedance is
a) $10\ \Omega$
b) $(5 + j5)\ \Omega$
c) $(5 - j5)\ \Omega$
d) $(20 - j20)\ \Omega$.
- vi) The direction of rotation of a DC motor is given by
a) Faraday's law
b) Lenz's law
c) Fleming's left hand rule
d) Fleming's right hand rule.
- vii) One commercial unit of electricity equals
a) one watt-hour
b) one watt-second
c) 1000 watt-second
d) 1000 watt-hour.
- viii) If a DC-DC buck converter of input voltage V has chopping frequency of ' f ' and T_{ON} as the on time of the switch, then the output voltage is
a) VfT_{ON}
b) Vf/T_{ON}
c) V/fT_{ON}
d) $VT_{ON}f$.
- ix) The insulation resistance of earth of an installation should be nearly
a) $1\ M\ \Omega$
b) $0.2\ M\ \Omega$
c) $0.1\ M\ \Omega$
d) $1\ k\ \Omega$.
- x) Form factor is the ratio of
a) RMS value to maximum value
b) Maximum value to RMS value
c) Average value to RMS value
d) RMS value to average value.
- xi) A device that converts a DC source into AC is called
a) Chopper
b) Rectifier
c) Inverter
d) Cyclo-converter.

GROUP - B

(Short Answer Type Questions)

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

2. Derive an expression for growth of current and decay of current through an inductor at transient state.

3. Derive an expression for resonant frequency of an R-L-C series resonant circuit. Why is this circuit called acceptor circuit ?
4. State and explain Norton's theorem with suitable example.
5. Explain the principle of operation of MCB.

GROUP - C

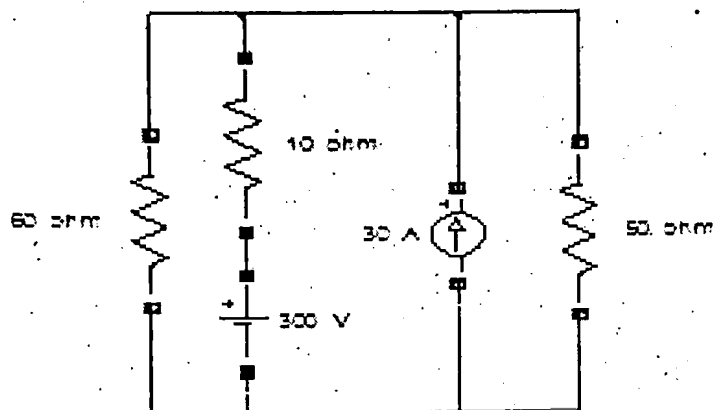
(Long Answer Type Questions)

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

6. a) Derive the relation between phase and line voltages for star connected load across 3 phase balanced system. Draw necessary circuit and phasor diagram.
b) A 3 phase 400 V circuit has a power factor of 0.8 (lagging). Two watt-meters are connected to measure the total input power which is 20 kW. Determine the reading of each wattmeter. 8 + 7
7. a) A balanced 3-phase supply in a 3-phase induction motor produces uniform rotating magnetic field with constant magnitude. Explain it analytically.
b) A 3-phase 6-pole 50 Hz induction motor has a slip of 1% at no load and 3% at full load. Determine (i) synchronous speed, (ii) no load speed, (iii) full load speed, (iv) frequency of rotor current at standstill, (v) frequency of rotor current at full load.
c) Draw speed *vs* torque characteristics of 3-phase induction motor. Can an induction motor run in synchronous speed ? 6 + 5 + 4
8. a) How many types of power are there ? Explain with their units. Establish their relationship using power triangle.
b) Explain why a *dc* series motor should not be started without a load ?

- c) What is Inverter ? Discuss the working principle of full bridge inverter with neat circuit diagram and waveforms. 5 + 5 + 5

9. a) State and explain Thevenin's theorem.
b) Find the current in the 50Ω resistor as shown in the figure below using Superposition theorem.



- c) Draw and explain B-H curve of a magnetic material. What is Eddy current loss and Hysteresis loss and how can these be minimized ? 5 + 5 + 5
10. a) Draw an equivalent circuit and phasor diagram at rated load (lagging power factor) of a single phase transformer.
b) A 125 kVA transformer having primary voltage of 2000 V at 50 Hz has 182 primary and 40 secondary turns. Neglecting losses, calculate
i) full load primary and secondary currents,
ii) the no-load secondary induced *emf*,
iii) the max. flux in the core.
c) What will happen if a DC supply is given to a transformer ? 7 + 6 + 2