

ELECTRICAL CIRCUITS

Time Allowed: 3 Hours

Full Marks: 60

Answer the following questions from Group-A, B & C as directed.

Group A

1. Choose the correct answer from the alternatives (any ten):

1 x 10

- i) Can Ohm's law be applied in an AC circuit? – a) Yes b) no c) depends on The RMS's current
d) Depends on the RMS voltage
- ii) In an RC circuit when the switch is closed, the response– a) do not vary with the time b) decays
with the time c) Rises with time d) first increases then decrease
- iii) Power factor of an inductive circuit is usually improved by connecting the capacitor to it in–
(a) parallel (b) series (c) either (a) or (b) (d) none of the above
- iv) The Apparent power is expressed in – (a) volt reactive (b) volt ampere (c) volt ampere reactive
(d) none of this
- v) An example of a linear bilateral element is – a) Resistance b) Vacuum tube c) Diode d) Transistor.
- vi) The transient response occurs – (a) only in the resistive circuit, (b) only in an inductive circuit,
(c) only in a capacitive circuit (d) both in (b) & (c)
- vii) Ideal current source has – a) zero internal resistance b) infinite internal resistance c) low value of
voltage d) large value of current
- viii) The Superposition theorem is essentially based on the concept of– (a) duality (b) linearity
(c) reciprocity (d) non-linearity
- ix) In a delta network, each element has the value R. The value of each element in the equivalent star
network will be a) $R/3$, b) $R/2$, c) $R/4$, d) $R/6$.
- x) A tank circuit is a– a) Parallel LC circuit b) Series LC circuit c) A resonant circuit d) A non-
resonant circuit
- xi) A capacitive load always has a _____ power facto a) Leading b) Lagging c) Zero d) Unity
- xii) The integral of a step function is _____ a) ramp function [a] b) An impulse function
c) Modified ramp function d) A sinusoidal function
- xiii) If there are M branch currents, then we can write _____ number of independent equations.
a) M-2 b) M-1 c) M d) M+1
- xiv) In an electrical circuit maximum power factor possible is– (a) 1 (b) 10 (c) 100 (d) infinite
- xv) Which among the following is regarded as short circuit forward transfer admittance?
a) y_{11} b) y_{12} c) y_{21} d) y_{22}

2. Fill in the blanks (any ten):

1x10

- i) The curve representing Ohm's law is _____.
- ii) The percentage of power increased from single phase to three phase is _____.
- iii) A three-phase 400 V motor draws 10 A at 0.8 lagging power factor. The power is consumed by this motor will be approximately _____.
- iv) Conductance is expressed in terms of _____.
- v) A closed path made by several branches of the network is known as _____.
- vi) Inductor is _____ element.
- vii) The Inverse Laplace transform of $(1/s+1)$ is _____.
- viii) The form factor is the ratio of _____.
- ix) $1V = 1$ _____ per coulomb
- x) In a purely inductive circuit power factor is _____.
- xi) Polar form of $3+j4$ is _____.
- xii) For a polyphase system, the number of Wattmeters required to measure power is equal to _____.
- xiii) After _____ time constants, the transient part reaches more than 99 percent of its final value.
- xiv) A super node is between _____.
- xv) During capacitor charging the voltage actually rises to _____ percent of its final value.

3. Answer the following questions (any ten):

1x10

- i) What is the condition for reciprocity of the Z parameter?
- ii) Define cut-off frequency
- iii) Distinguish between Thevenin's theorem and Norton's theorem.
- iv) What is the statement of Kirchoff's Current Law (KCL)?
- v) What is the Laplace transform of a unit impulse function?
- vi) What is the unit of admittance?
- vii) Define specific resistance.
- viii) Define balanced load
- ix) For which system two wattmeter method is applicable?
- x) What is the crest or amplitude factor?
- xi) What is phasor?
- xii) What is the value of z_{11} in terms of y parameters?
- xiii) Define the bi-lateral circuit.
- xiv) Give an example of a non linear element.

Group B

4. Answer the following questions (any six):

2x6

- ~~i)~~ Define Q-factor?
- ~~ii)~~ State Maximum power transfer theorem.
- ~~iii)~~ What is an Impedance triangle?
- iv) What is the difference between a mesh and a loop?
- v) How many phase sequences are there? Name them.
- ~~vi)~~ Define resonance and bandwidth.
- vii) Define active and reactive power.
- viii) What is a resonance in a parallel circuit?
- ~~ix)~~ What is transient time?
- x) To draw the phasor diagram of a parallel circuit, which quantity should be taken as reference and why?

Group C

5. Answer the following question (any one):

1x6

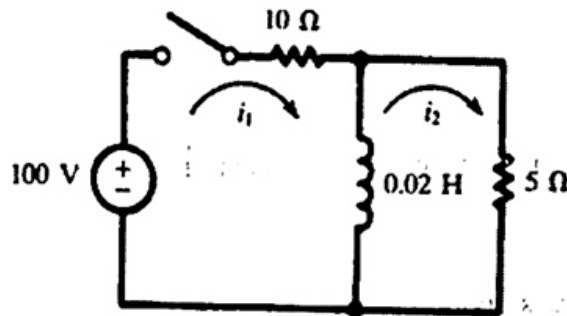
- a) Derive the relation between line current and phase current in a balanced 3-phase delta connected system.

- b) Draw impedance characteristics of the RLC series circuit at resonance.
- c) A dc source of strength 6 volts is driving a load whose resistance varies from two to twenty ohms. Compute the variation in terminal voltage for the source as a percentage. Take the source resistance as two ohms?

6. Answer the following question (any one):

1x6

- a) Calculate the Laplace transform for the following function:
(i) e^{-5t} (ii) $e^{-2t} t^2$ (iii) $e^{-3t} \sin 5t$
- b) Prove initial value theorem is context with Laplace theorem.
- c) In the two-mesh network of the given figure, find the currents i_1 and i_2 that result when the switch is closed using initial and final value theorems.



7. Answer the following question (any one):

1x6

- a) Derive the Laplace transform of unit step function.
- b) A coil of 10H inductance and 5 ohm resistance is connected in parallel with a 20 ohm resistor across a 100 V dc supply which is suddenly disconnected. Find a) the initial current after switching, b) the voltage across the 20 ohm resistor after 0.3 sec.
- c) A d.c constant voltage source feeds a resistance of 2000 kohm in series with a 5 micro farad capacitor. Find the time taken for the capacitor when the charge retained will be decayed to 50% of the initial value. The voltage source being short circuited.