CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR
(Deemed to be University)
KOKRAJHAR :: BTR :: ASSAM :: 783370
END – SEMESTER EXAMINATION
DIPLOMA

Session: July-December, 2024 Semester: 3rd Time: 3Hrs. Full Marks: 100
Course Code: **DIE 301** Course Title: **Electrical Circuits & Networks**

QUESTION NO. 1 ISCOMPULSORY AND ANSWER ANY FOUR (4) FROM THE REST

Q1:

a) Match the following: **5**

Column-A	**Column-B**
Effective value of an alternating quantity referred to as	90^0
In a pure capacitive circuit, the current leads the voltage by	unknown resistance
The phase difference between voltage and current in a pure resistive circuit	rotating vector
The Wheatstone bridge is used to measure	rms value
In phasor representation, a sinusoidal quantity is represented as	0^0

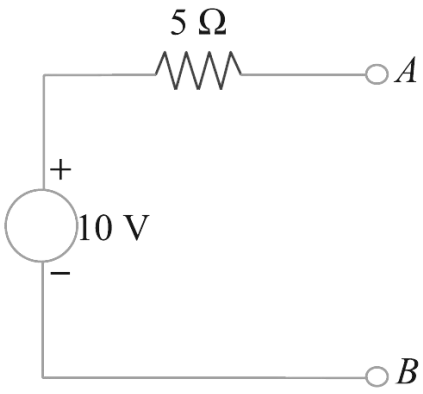
b) State **True** or **False**. If false, write the **correct statement**. **5**

i) In a parallel circuit, the total resistance is always higher than the resistance of the individual components.
ii) According to Kirchhoff's Voltage Law (KVL), the total sum of the voltage around a closed circuit loop is equal to zero.
iii) The voltage divider circuit can be used to obtain a lower voltage from a higher voltage source.
iv) The peak value of a sinusoidal waveform is always equal to its average value.
v) Phase shift refers to the horizontal shift of a waveform on a time axis, measured in degrees or radians.

c) Fill in the blanks: **5**

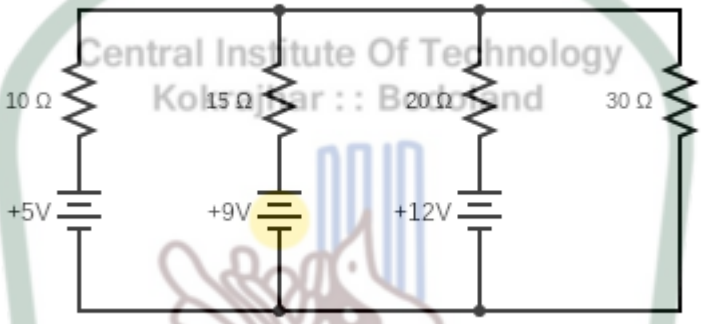
i) In the context of alternating quantities, what does the term 'frequency' refer to _____
[time taken to complete one full cycle/ number of cycles completed per second/ phase angle between current and voltage]
ii) The 'effective' or 'RMS' value of an alternating current waveform is defined as_____
[square root of the mean of the squares of instantaneous values/ sum of instantaneous values/ peak value divided by 2]
iii) In a pure resistive circuit_____
[circuit does not consume power/ Voltage and current are in phase/ only inductive reactance is present]
iv) In a series RLC circuit, _____ represents the total impedance.
[sum of resistances only/ $Z = \sqrt{R^2 + (X_L - X_C)^2}$ */ difference between peak and RMS values]*
v) In terms of power in AC circuits, the 'power triangle' represent_____
[sum of powers in parallel circuits/ phase relationship between current and voltage/ relationship between real power, reactive power, and apparent power]

d) Convert the voltage source of figure below into an equivalent current source **5**

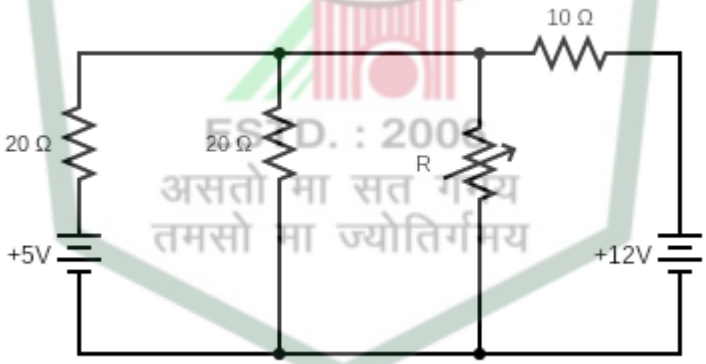


Q2:

a) Use Millman's theorem, to find the voltage across 30Ω resistance: **10**



b) Calculate the value of **R** which will absorb maximum power from the circuit below. **10**

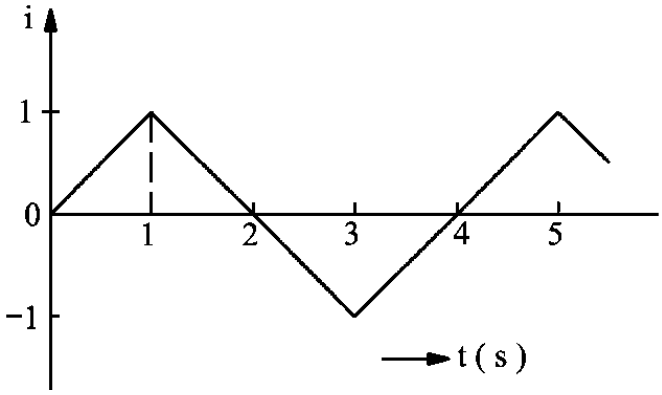


Q3:

a) The maximum values of the alternating voltage and current are 400 V and 20 A respectively in a circuit connected to 50 Hz supply and these quantities are sinusoidal. The instantaneous values of the voltage and current are 295 V and 12 A respectively at t = 0 both increasing positively. **8**

Write down the expression for voltage and current at time t.

b) Through a coil of inductance 1 Henry, a current of the wave-form shown in the figure below is flowing. Sketch the wave form of the voltage across the inductance and calculate the r.m.s. value of the voltage. **8**



c) State and explain the KCL & KVL. **4**

Q4:

a) A 50-Hz voltage of 115 V (r.m.s.) is impressed on a 100 ohm resistance : **9**

(i) Write the time equations for the voltage and the resulting current. Let the zero point of the voltage wave be at t = 0

(ii) Show the voltage and current on a time diagram.

(iii) Show the voltage and current on a phasor diagram.

b) A 50-Hz voltage of 230 volts effective value is impressed on a capacitance of 2 μF. **6**

(i) Write the time equations for the voltage and the resulting current. Let the zero axis of the voltage wave be at t = 0.

(ii) Show the voltage and current on a phasor diagram.

c) Calculate the total resistance between the terminals A & B in the figure below. **5**

Q5:

a) A vector is represented by 20 $e^{-j2\pi/3}$. Write the various equivalent forms of the vector and illustrate by means of a vector diagram, the magnitude and position of the above vector. **4**

b) In a series circuit containing pure resistance and a pure inductance, the current and the voltage are expressed as : **10**

$i(t) = 5 \sin (314\, t + 2\, \pi/3)$ and

$v(t) = 15 \sin (314\, t + 5\, \pi/6)$

(i) What is the impedance of the circuit?

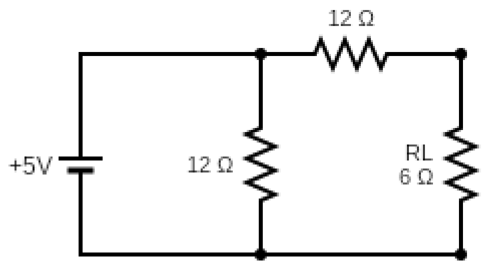
(ii) What is the value of the resistance?

(iii) What is the inductance in henrys?

(iv) What is the average power drawn by the circuit?

(v) What is the power factor?

c) Apply Thevenin's theorem to calculate the current through the 6 Ω resistor of the circuit of figure below: **6**



Q6:

a) An a.c. voltage (80 + j 60)volts is applied to a circuit and the current flowing is (− 4 + j 10) amperes. **9**

Find

(i) impedance of the circuit

(ii) power consumed and

(iii) Phase angle.

b)

A resistance of 20 Ω, an inductance of 0.2 H and a capacitance of 100 μF are connected in series across 220-V, 50-Hz mains. **10**

Determine the following

(i) impedance

(ii) current

(iii) voltage across R, L and C

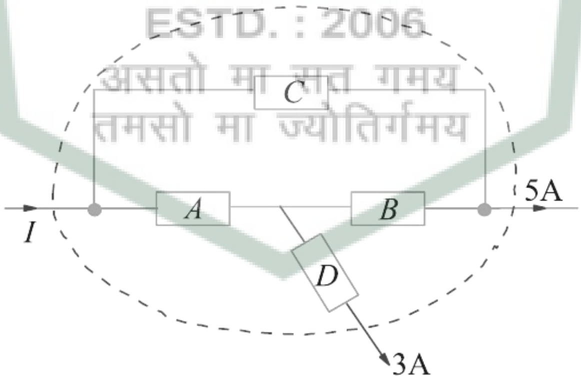
(iv) power in watts and VA

(v) p.f. and angle of lag.

c) State the Ohm's Law. **1**

Q7:

a) Apply *KCL* to find the value of *I* in the figure below. **4**



b) Write short notes on: (any four) **4 x 4 = 16**

i) Power factor

ii) Resonance

iii) Form Factor

iv) Maximum Power Transfer Theorem

v) Norton's theorem

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