KATHMANDU UNIVERSITY
End Semester Examination
September 2024

Marks Scored:

Level : B.E./B.Sc.
Year : I
Course : ENGG 112
Semester : II

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date : 17 SEP 2024

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate answer. Symbols have their usual meanings.

1. Temperature coefficient of resistance is expressed in terms of _____
   a. Ohms/°C b. Mhos/Ohms°C c. Ohms/Ohms°C d. Mhos/°C

2. Two copper conductors have equal length. The cross sectional area of one conductor is four times that of the other. If the conductor having smaller cross sectional area has a resistance of 40 Ohms the resistance of the other conductor will be_____
   a. 160 Ohms b. 80 Ohms c. 20 Ohms d. 10 Ohms

3. Three identical resistors are connected in parallel and then in series. The resultant resistance of the first combination of the second will be_____
   a. 9 times b. 1/9 times c. 1/3 times d. 3 times

4. Two lamps of 100 Watt and 40 Watt are connected in series across a 230 Volts A.C supply. The correct statement is
   a. 100 Watt lamp will glow brighter b. 40 Watt lamp will glow brighter
   c. Both lamps will glow equally bright d. 40 Watt lamp will fuse out

5. If one leg of a parallel circuit is opened out, the total current will_____ .
   a. Not change b. Increase c. Decrease d. Become zero

6. In a series circuit with unequal resistances, _____ .
   a. The highest resistance has the most of the current through it
   b. The lowest resistance has the highest voltage drop
   c. The lowest resistance has the highest current
   d. The highest resistance has the highest voltage drop

7. The total resistance of insulator _____ .
   a. increases with an increase in temperature.
   b. decreases with an increase in temperature
   c. remains the same with an increase in temperature
   d. becomes zero with an increase in temperature.

8. In Superposition theorem, when we consider the effect of one voltage source, all the other current sources are
   a. Shorted. b. Opened. c. Removed. d. Undisturbed.

9. Thevenin voltage is the _____ and Thevenin resistance is calculated by _____ .
   a. Open circuit voltage, shorting all voltage sources
   b. Short circuit voltage, opening all current sources
   c. Open circuit voltage, shorting all voltage sources and opening all current sources
   d. Short circuit voltage, opening all voltage sources and shorting all current sources

10. The maximum power is delivered to a circuit when source resistance is _____ load resistance
    a. greater than
    b. equal to.
    c. less than.
    d. greater than or equal to

11. A current source connected in parallel with a resistor can be converted to a
    a. Voltage source in series with a resistor.
    b. Current source in parallel with a resistor.
    c. Voltage source in parallel with a resistor.
    d. Cannot be transformed.

12. A circuit is said to be selective if it has a _____ peak and _____ bandwidth.
    a. Blunt, narrow b. Sharp, narrow c. Sharp, broad d. Blunt, broad

13. At resonance, the capacitive energy is _____ inductive energy and electrostatic energy is _____ the magnetic energy.
    a. Equal to, equal to
    b. Equal to, less than
    c. Less than, greater than
    d. Greater than, equal to

14. The current in the capacitor leads the voltage in a series RLC circuit, _____ the resonant frequency
    a. Above
    b. Below
    c. Equal to
    d. Depending upon the tuning of

15. If a coil is wound around a steel core and electric current is passed through the coil, the steel core acts as
    a. Electromagnetic
    b. Permanent magnet
    c. Neither electromagnet nor permanent magnet
    d. Either electromagnet or permanent magnet

16. The instantaneous value of two alternating voltages are given as $V_1 = 60\sin\theta$ Volts and $V_2 = 40 \sin(\theta - \pi/3)$ Volts. The instantaneous sum of resultant voltage is _____ .
    a. 87.2sin (36.5°) Volts
    b. 87.2sin (0.5°) Volts
    c. 87.2sin (26.5°) Volts
    d. 87.2cos (36.5°) Volts

17. If a voltage of 2+5j Volts and another voltage of 3+6j Volts across two different resistors are connected in series in a circuit, the total voltage in the circuit is _____ .
    a. 2+5j Volts b. 3+6j Volts c. 5+11j Volts d. 5+10j Volts

18. The sum of instantaneous power in a three phases in a three phase system _____
    a. Is zero
    b. Remains constant
    c. Thrice the line frequency
    d. Twice the line frequency

19. The purpose of a neutral conductor in a star connected three phase system is _____
    a. To increase the voltage between two phases as it assists in load balancing
    b. To use for grounding the system, and it helps in equalizing phase voltages
    c. To use for phase shifting, and it helps in generating higher voltage
    d. Is used for over current protection, and it helps in phase separation

20. In a three phase balanced star connected system, the angle between line current and line voltages are _____, with "φ" = angle between phase voltage and phase current
    a. In phase b. 30°+φ leading c. 30°+φ lagging d. 30°-φ lagging

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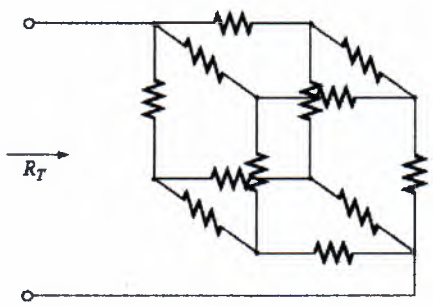
SECTION "B"
[4Q. × 10 = 40 marks]

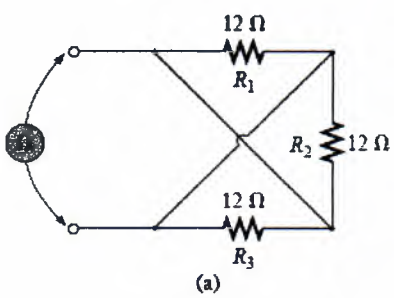
Attempt *ANY FOUR* questions. *Assume any suitable data if required*

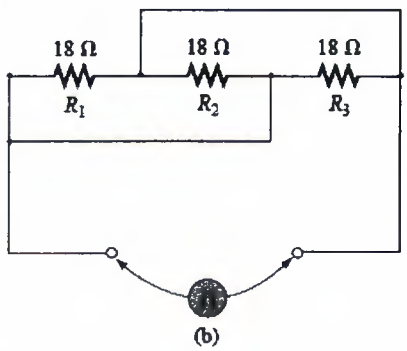
1.

a. Calculate the total resistance, R_T in the circuit below. Consider all the resistors of the cube to be of 10 Ω. [4]



b. Determine the reading of the Ohmmeter (shown as symbol, 'Ω') for the sub-circuits as shown in figure below. [1.5+1.5=3]

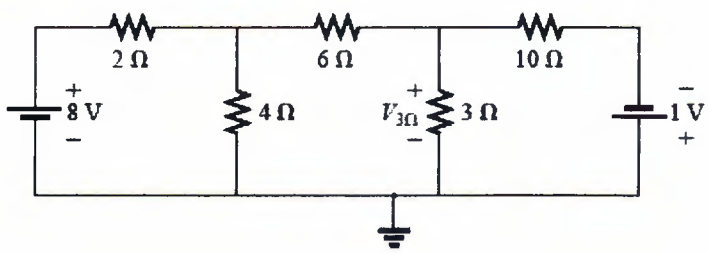




c. Describe any three differences between a star (Y) connected and delta (Δ) connected three phase A.C supply system. Explain with a neat sketch, the type/s of supply system implemented in Nepal for distributing electricity to the residential consumers. [1.5+1.5=3]

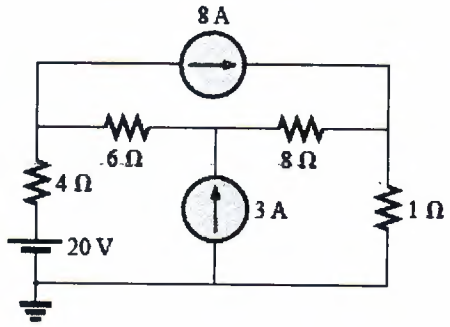
2.

a. Find the voltage across the 3Ω resistor by using Nodal analysis. [3]



P.T.O.

b. Find the current through each element of the networks $I_{4\Omega}$, $I_{6\Omega}$, $I_{8\Omega}$, $I_{1\Omega}$ as shown using mesh analysis. [1+1+1+1=4]

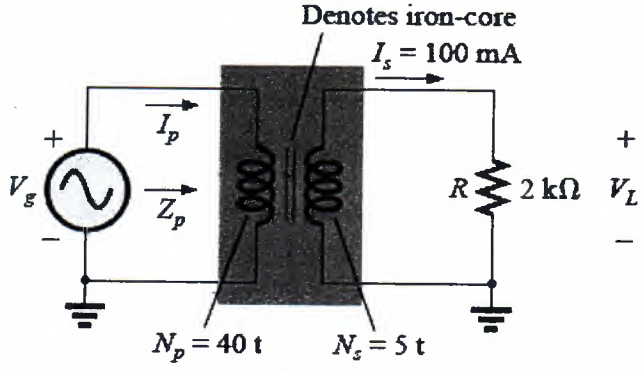


OR

For the iron core transformer, find

i. The magnitude of the current in the primary and impressed voltage acros the secondary.

ii. The input impedance of the transformer



c. What is a resonance? Mention the conditions for a resonance and derive the expression for a resonance frequency considering a series RLC circuit. [1+1+1=3]

3.

a. Derive the e.m.f equation of a transformer and prove that the current transformation ratio in a transformer is reciprocal to that of the turn's ratio. [2+2=4]

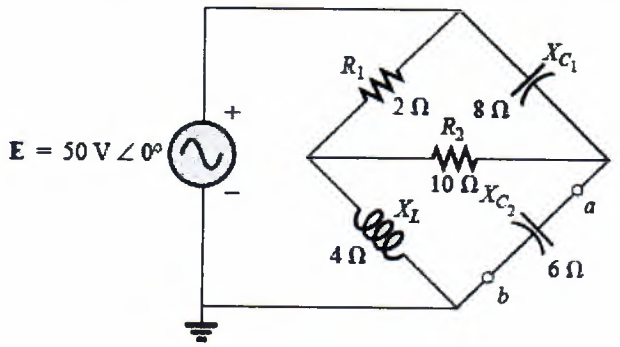
b. A series RLC circuit is designed to resonant at $\omega_s = 10^5$ rad/s, have a bandwidth of 0.15 ω_s, and draw 16 W from a 120 Volt source at resonance. [3]

i. Determine the value of R.

ii. Find the bandwidth in hertz.

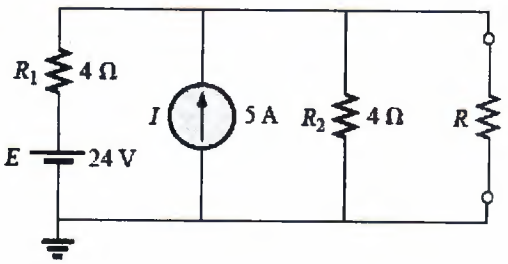
iii. Determine the values of L and C.

c. Find the Thevenin's equivalent circuit for the portions of the network external to the elements between points 'a' and 'b'. [3]

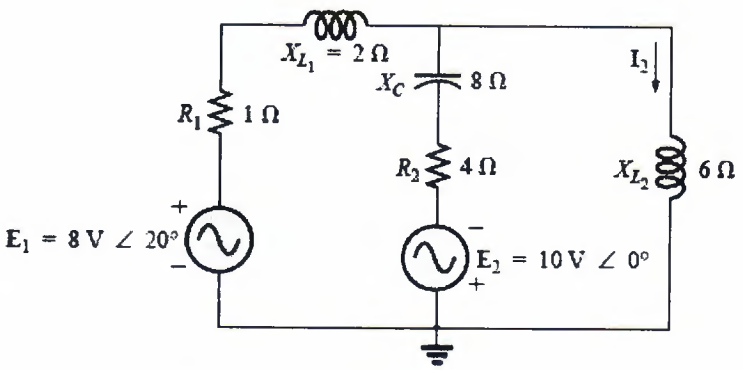


4.

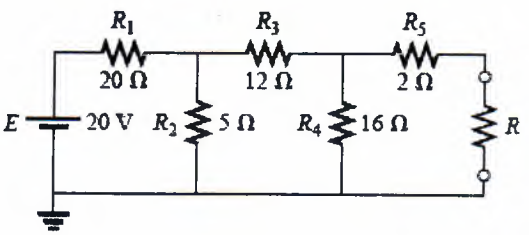
a. For the network shown, find the value of resistor, R for maximum power to R, and determine the maximum power to R. [3]



b. Find the current I_2 in the network below. [3]

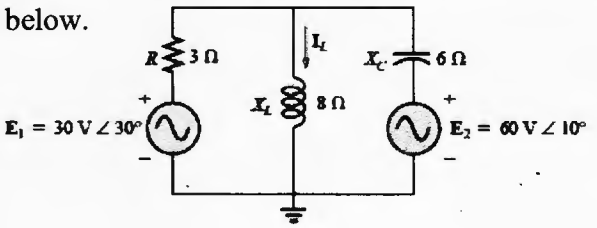


c. Find the Norton equivalent circuit for the network external to the resistor R as shown in the figure below. [4]

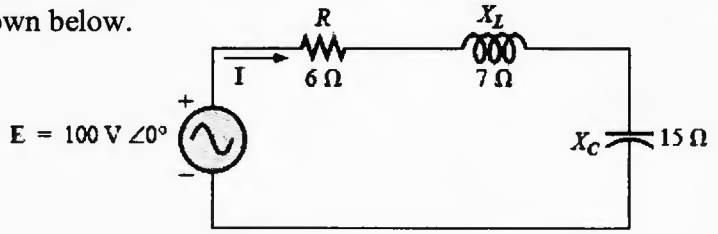


5.

a. Using Superposition Theorem, determine the current through the inductance X_L for the network given below. [3]



b. Find the active power, reactive power, apparent power, and the power factor for the network as shown below. [4]



c. The phase sequence of the star connected (Y) connected generators is ABC. [3]

i. Find the phase angles θ_2 and θ_3

ii. Find the magnitudes of the line voltages

iii. Verify that, since the load is balanced, current through the neutral, $I_N = 0$