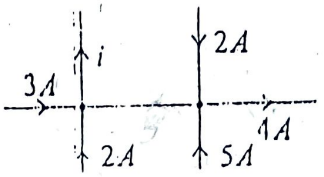
KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ENGINEERING
Mid-Semester Examination
EE 151 APPLIED ELECTRICITY

November 2016 — 1 Hour

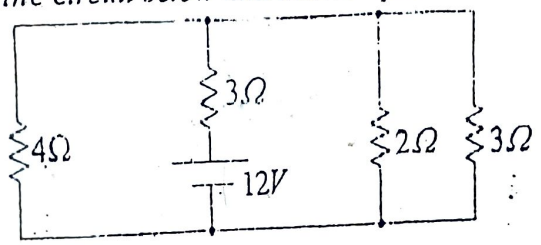
Answer all questions by shading the correct option on the answer sheet provided

Determine the value of i in amperes in the figure below.

A. -3 B. 3 C. 6 D. -6 E. 8



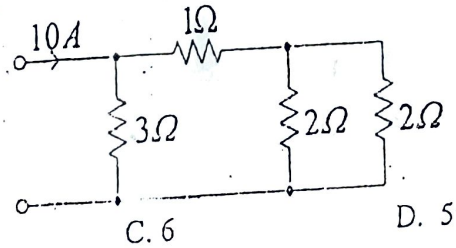
Consider the circuit below and answer questions 2 and 3.



2. Determine the current in amperes supplied by the battery.
A. 3.15 B. 2.15 C. 3.06 D. 2.61 E. 3.21

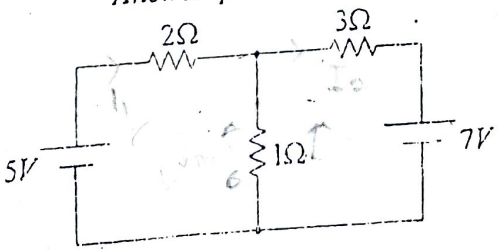
3. What is the voltage in volts across the 4Ω resistor.
A. 2.82. B. 2.55 C. 5.55 D. 4.17 E. 2.37

4. Find the current in amperes through the 3Ω resistor of the circuit below.



A. 2.5 B. 4 C. 6 D. 5 E. 3.5

It is desired to use Thevenin's theorem to find the current in the 1Ω resistor of the circuit below. Answer questions 5-7.



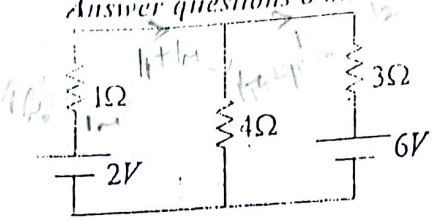
5. What is the value of Thevenin's voltage in volts?
A. 6.28 B. 2.86 C. 3.25 D. 3.75 E. 5.8

6. Find the Thevenin's resistance in ohms?
A. 1.2 B. 5 C. 1.5 D. 0.83 E. 1.33

7. What is the current in the 1Ω resistor in amperes?
A. 1.45 B. 1.48 C. 2.64 D. 1.70 E. 2.85

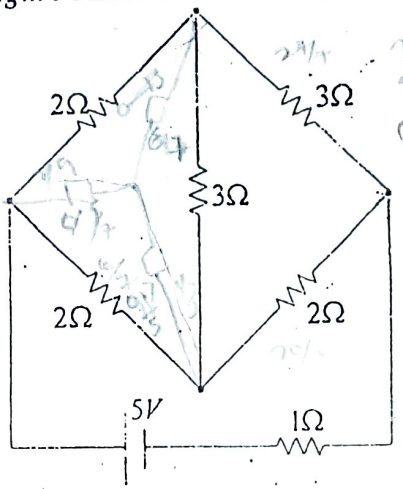
It is desired to use Norton's Theorem to find the current in the 1Ω resistor of the circuit belo

Answer questions 8 and 9.



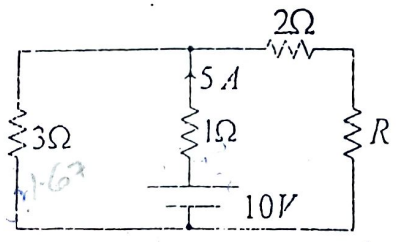
8. What is the magnitude of Norton's current?
   A. 1.23 B. 0.63 C. 1.33 D. 0.83 E. 1.03
9. What is the current in the 1Ω resistor in amperes?
   A. 0.84 B. 1.63 C. 0.53 D. 0.72 E. 1.03

Consider the figure below and answer questions 10 and 11.

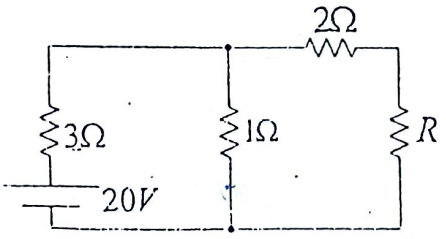


10. Determine the total resistance of the circuit in ohms.
    A. 3.03 B. 3.63 C. 3.58 D. 3.72 E. 3.21
11. What is the current in amperes in the 1Ω resistor.
    A. 1.56 B. 1.40 C. 1.35 D. 1.38 E. 1.65

12. Consider figures A and B below and find the current in amperes in the 1Ω resistor of figure B.



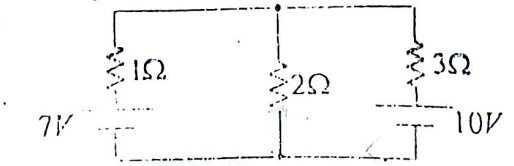
A



B

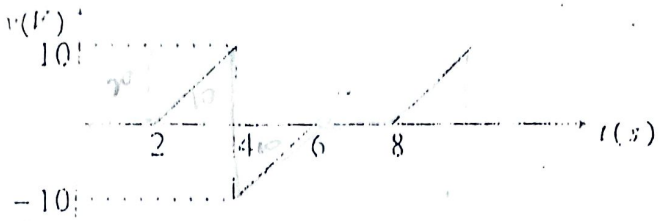
A. 2.54 B. 3.33 C. 3.64 D. 6.67 E. 3

13. It is desired to use superposition theorem to find the current in the 2Ω resistor of the circuit below. the current contribution of the 7V battery?



A. 1.03 B. 1.98 C. 1.68 D. 1.91 E.

etermine the effective value in volts of the waveform below.



7.32 B. 6.81 C. 5.27 D. 0 E. 4.71

etermine the average value of the voltage $v = 5 + 7\sin(wt - 10^0) + 12\sin(3wt + 15^0)$.

13.90 B. 1.02 C. 5 D. 9 E. 8

lculate the effective value in amperes of the current $i = 3 + 8\sin(wt - 10^0) + 10\sin(3wt + 15^0)$.

8.53 B. 11.32 C. 10.12 D. 9.54 E. 8.02

Given that $i_1 = 5\sin(wt - 30^0)$ and $i_2 = 6\sin(wt + 45^0)$ answer questions 17 – 20.
[Do all calculations to 2 decimal places]

etermine the effective value of $i_1 + i_2$ in amperes.

6.18 B. 4.17 C. 7.14 D. 5.23 E. 4.28

hat is the phase angle between the resultant vector of $i_1 + i_2$ and the reference axis?

13.24^0 B. 30.01^0 C. 12.15^0 D. 10.23^0 E. 11.48^0

etermine the peak value of $i_1 - i_2$.

6.81 B. 6.74 C. 8.15 D. 5.89 E. 7.23

hat is the phase displacement between the resultant vector of $i_1 - i_2$ and i_1.

56.57^0 B. 61.34^0 C. 59.23^0 D. 67.45^0 E. 50.12^0

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
College of Engineering
(BSc. Engineering) First Semester Examination
EE 151 APPLIED ELECTRICITY

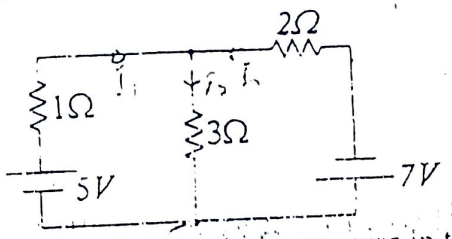
ember 2012 Time: 2½ Hours

TRUCTIONS
(a) Answer all 50 questions (if you can) by shading the correct option on the multiple choice answer sheet provided. DO NOT CIRCLE ANY ANSWER ON THE QUESTION PAPER.
(b) If you do not find your answer among the options, write it down on the question paper as option (F).
(c) Make sure you shade well. The MACHINE WILL REJECT IMPROPER SHADINGS and this will go against you.
(d) Uses available spaces on the question paper and the supplementary sheets for rough work.
(e) At the end of the examination, submit question paper, multiple choice answer sheet and supplementary sheets to the invigilator(s).
(f) When necessary, calculate to two decimal places.

Programme ELECTRICAL ENGINEERING Index Number 7756212

(Each correct answer will earn you 1.4marks)

Use the information below to answer questions 1 and 2.
It is desired to use Kirchhoff's laws to find the currents in all parts of the circuit below.



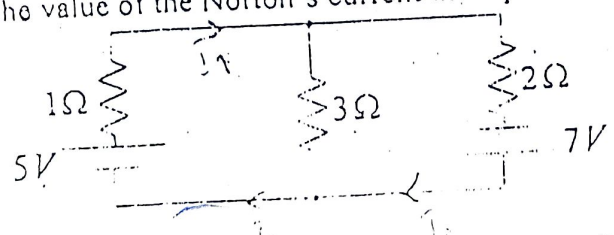
1. What is the current in amperes in the 1Ω resistor?
A. 4.18 ✓ B. 3.65 C. 5.36 D. 0.25 E. 2.16

2. Determine the current in amperes in the 3Ω resistor.
A. 0.25 B. 0.31 C. 1.01 D. 0.35 E. 0.27 ✓

3. Which of the following statements is/are correct?
I Norton's theorem applies only to linear networks.
II Kirchhoff's laws apply to both linear and non-linear networks.
III Norton's and Thevenin's equivalent circuits are interchangeable.

A. I B. II and III ✓ C. I, II and III D. I and II E. III

4. It is desired to use Norton's theorem to find the current in the 3Ω resistor of the circuit below. What is the value of the Norton's current in amperes?



A. 8.5 B. 1.5 ✓ C. 2.3 D. 4.5 E. 3.2

5. A 1Ω resistor is connected between terminals X and Y of a circuit. The short circuit current and Thevenin's resistance between the two terminals are 3A and 5Ω respectively. What is the current in amperes through the 1Ω resistor?

A. 4.5 B. 0.5 C. 2.3 D. 2.05 E. 2.5

Use the information below to answer questions 6 to 8.

It is desired to use Superposition theorem to find the current through a 3Ω resistor which is being supplied by a 10V battery with an internal resistance of 2Ω and a 9V battery with an internal resistance of 1Ω.

6. What is the current contribution in amperes of the 10V battery?

A. 0.23 B. 0.78 C. 1.13 D. 0.91 E. 0.72

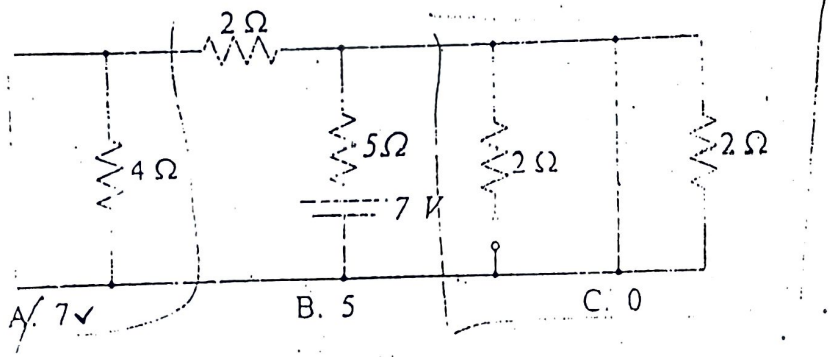
7. What is the current contribution in amperes of the 9V battery?

A. 1.64 B. 1.13 C. 1.43 D. 3.05 E. −2

8. Hence or otherwise, find the current in amperes through the 3Ω resistor.

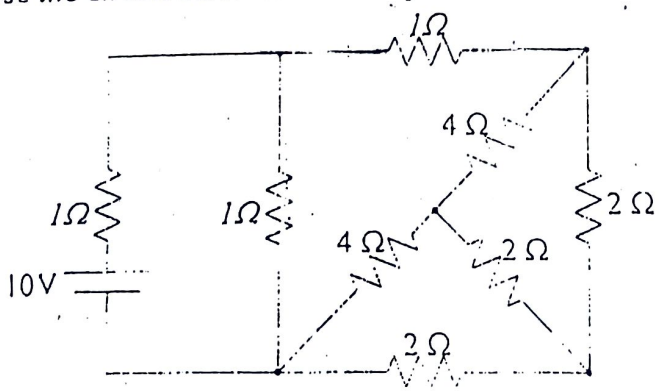
A. 1.36 B. 1.66 C. 2.56 D. 1.96 E. 4.18

9. Determine the total resistance in ohms of the circuit below.



A. 7 B. 5 C. 0 D. 1.43 E. 2.07

Use the circuit below to answer questions 10 and 11



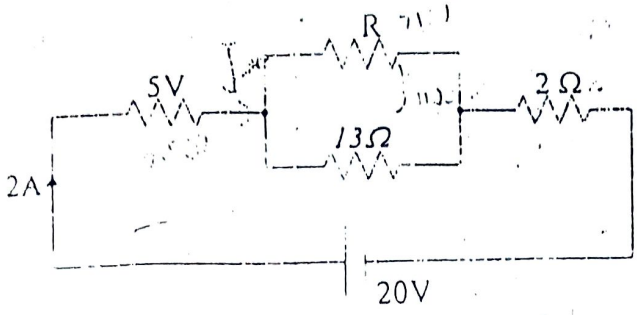
10. Determine the total resistance in ohms of the circuit.

A. 1.53 B. 2.07 C. 1.23 D. 1.79 E. 2.67

11. What is the current in amperes supplied by the battery?

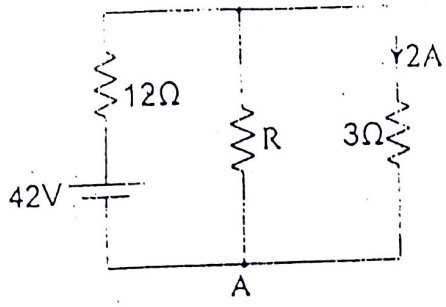
A. 4.83 B. 6.54 C. 3.75 D. 8.13 E 5.59

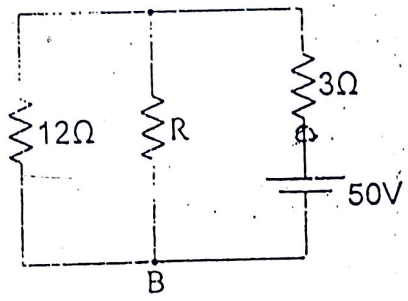
12. Consider the circuit below and find current in amperes through the 13Ω resistor.



A. 0.85 B. 0.75 C. 0.95 D. 0.65 E. 1.12

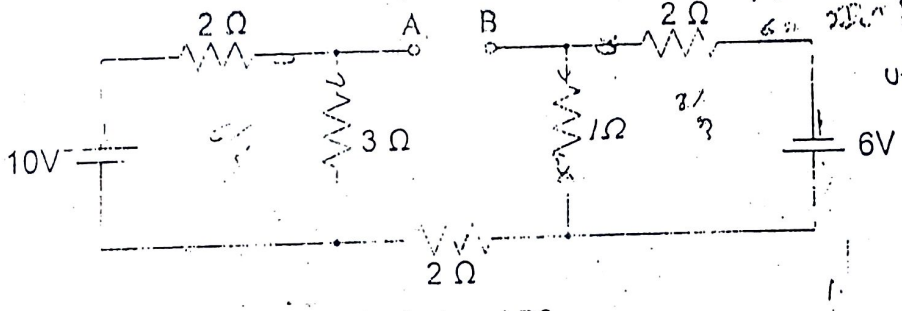
13. Consider the circuit below and find the current in amperes in the 3Ω resistor of circuit B.





A. 9.14 B. 8.14 C. 7.14 D. 6.14 E. 5.14

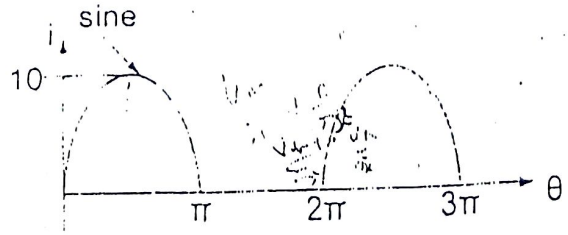
Use the circuit below to answer questions 14 and 15.



14. What is the voltage across terminals A and B?
A. 4 B. 8 C. 6 D. 9.5 E. 6.4

15. Determine the current through a 3Ω resistor that is connected between terminals A and B.
A. 1.37 B. 1.07 C. 1.27 D. 1.17 E. 1.70

Use the figure below to answer questions 16 and 17.



16. Determine the DC value of the waveform in amperes.
A. 2.67 B. 3.67 C. 5.18 D. 4.18 E. 3.18

17. Find the effective value of the current waveform in amps

A. 5 B. 7.07 C. 4 D. 4.5

18. Given that $i_1 = 2 + 3\sin(\omega t + 10^o)$ and $i_2 = 1 + 5\sin(\omega t + 10^o)$, find the effective value in amperes of $i_3 = i_1 + i_2$.

A. 8.66 B. 6.4 C. 4.6 D. 6.68 E. 6.86

19. Given that $V_1 = 10\sin(\omega t - 10^o)$ and $V_2 = 5\sin(\omega t + 10^o)$, find the effective value in volts of $V_1 - V_2$

A. 5 B. 3.54 C. 10.61 D. 5.56 E. 3.75

20. A series circuit comprises a resistor, a capacitor and an inductor. The voltages across the elements are $2V$, $5V$ and $8V$ respectively. Determine the supply voltage in volts.

A. 15 B. 13.15 C. 3.61 D. 5.13 E. 4.33

21. A series RL circuit consumes $1kW$ when connected to a $100V$, 50Hz supply. Given that the voltage across the inductor is $60V$. Find the resistance of the circuit in ohms.

A. 5.30 B. 1.60 C. 6.54 D. 5.67 E. 6.40

Use the information below to answer questions 22 and 23.

A house with two rooms receives a $230V$, $50Hz$ supply. The loads of the two rooms are $1kVA$ at 0 lagging and $0.5kVA$ at 0.95 leading.

22. Find the apparent power in kVA consumed by the building.

A. 1.5 B. 1.38 C. 1.49 D. 1.25 E. 1.28

23. What is the current in amperes drawn from the supply?

A. 6 B. 6.48 C. 7.28 D. 6.52 E. 5

Use the information below to answer questions 24 and 25.

The voltage across and the current through a load are $(10 + j5)V$ and $(2 - j1)A$ respectively.

24. What is the reactive power in VAr consumed?

A. 15 B. 0 C. 20 D. 25 E. 10

25. What is the power factor of the load?

A. 0.8 leading B. 0.8 lagging C. 0.6 leading D. 0.6 lagging E. 1

Use the information below to answer questions 26 to 28.

A $50\mu F$ capacitor is connected in parallel across a coil of inductance $100mH$ and resistance 5Ω a 230V, 50Hz supply.

26. What is the current in amperes drawn from the supply?

A. 3.71 B. 3.13 C. 3.25 D. 3.67 E. 3.

27. Determine the current in the coil in amperes.

A. 5.36 B. 7.23 C. 2.40 D. 5.40 E. 8.

28. Calculate the power in watts drawn from the supply.

A. 28.80 B. 143.68 C. 145.8 D. 329.67 E. 26

Use the information below to answer questions 29 and 30.

A single phase motor drives a $2kW$ load. The losses in the motor circuit total $50W$. The supply voltage is $230\sqrt{2}\sin\omega t\,V$ while the current drawn is $B\sin(\omega t - 30^{o})A$.

29. Determine the apparent power in VA consumed by the motor.
A. 2309.40 B. 3209.47 C. 2567.67 D. 2367.14 E. 2318.33

30. What rating of shunt capacitor in VAr is required to make the motor operate at unity power factor in relation to the supply?
A. 1183.58 B. 2309.47 C. 1267.31 D. 3209.47 E. 2053.17

31. Which of the following statements is/are true?
I. The phase and line voltages of a star-connected system are NOT in phase
II. Three phase motors are more robust than single-phase motors of the same rating.
III. The phase and line voltages of a delta system are in phase.
A. II B. II and III C. I and II D. I, II and III E. I

Use the following information to answer questions 32 and 33.

A three-phase transformer whose secondary is connected in star is used to supply a balanced delta connected load of $2kW$ at a power factor of 0.85 lagging. The phase voltage of the secondary star is 240.

32. What is the line current drawn by the load.
A. 3.27 B. 5.66 C. 3.67 D. 4.67 E. 2.08

33. Determine the reactance of the load per phase.
A. 127.12 B. 108.05 C. 367.02 D. 66.97 E. 118.23

34. The current in the neutral of a three-phase four-wire $415V$, $50Hz$ system feeding resistive loads of P_1, $2kW$, $3.5kW$ in phases 1, 2 and 3 respectively is $14.63\angle 21.75^{0}$. Determine the value of P_1 in kW.
A. 5.13 B. 5.27 C. 6.01 D. 5 E. 7.25

Use the information below to answer questions 35 to 40.

A three-phase 430V, 50Hz system is used to supply 3 single phase loads and 1 three-phase motor. The single phase loads are: $Z_R = 50 + j0$, $Z_Y = 25 + j4$ and $Z_B = 30 - j4$. The 3-phase motor runs at an output of 2kW at 0.85pf lagging and is 80% efficient. Neglect the impedance of the distribution lines.

35. Determine the motor line current in amperes.
A. 3.25 B. 4.33 C. 3.71 D. 2.67 E. 3.95

36. Find the reactive power in VAr consumed by the motor.
A. 1241.23 B. 1549.81 C. 1613.05 D. 1314.33 E. 1067.25

37. What current in amperes is drawn by the single-phase load on the blue phase?
A. 8.15 B. 8.26 C. 8.20 D. 8.92 E. 8.03

38. What is the power in kW consumed by the single phase load on the yellow phase?
A. 2.65 B. 2.37 C. 2.17 D. 2.41 E. 2.78

39. Find the magnitude of the neutral current in amperes.
A. 6.32 B. 6.35 C. 6.78 D. 6.98 E. 6.43

40. Determine the line current in amperes in phase 1 of the supply system.
A. 8.92 B. 8.33 C. 4.97 D. 6.35 E. 5.27

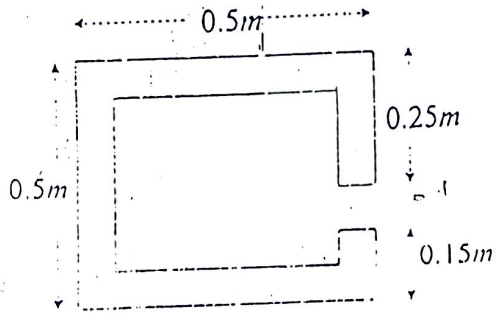
41. Which of the following statements about magnetic circuits is false?
I. For the same dimension, wood has a higher reluctance than air.
II. The flux density of a series magnetic circuit comprising different parts is always the same for all parts.
III. For the same source, different materials but of the same dimension will have the same magnetic field intensity.

A. III B. II C. I, II and III D. I and II E. I and II

41 to 45

Use the information below to answer questions 42 to 46.

A magnetic circuit comprises a rectangular steel former and air gap as shown in the figure below. The relative permeability of steel is 3000 and the cross sectional area is $0.01m^2$. A coil of 3000 turns wound on the steel gives rise to a flux density of $0.1T$ in the air gap.



42. Determine the reluctance of the air gap in AT/Wb.
A. 2012431.15 B. 1260351.13 C. 1989436.79 D. 663.15 E. 636.25

43. What is the reluctance in AT/Wb of the steel?
A. 663.15 B. 33126.25 C. 23141.33 D. 12599.77 E. 1663.15

44. Find the coil current in amperes.
A. 3.67 B. 2.67 C. 1.67 D. 4.13 E. 3.13

45. Calculate the strength of the magnetic field in the steel in A/m.
A. 26.53 B. 24.15 C. 25.27 D. 23.18 E. 24.95

46. Obtain the mmf drop in the air gap in AT.
A. 5797.57 B. 7579.75 C. 7957.75 D. 9775.57 E. 7759.75

47. A coil of 3000 turns is wound on a wooden former which has a rectangular cross section of $0.1m \times 0.$ If the length of the wooden former is $2m$, find the current in mA in the coil that will produce a flu $10\mu Wb$ in the wood.
A. 107 B. 106 C. 105 D. 104 E. 102

Use the information below to answer questions 48 to 50.

A coil of 2000 turns is wound on a circular wooden former which has a mean radius of 30cm and a cross-sectional area of $5cm^2$. The coil carries a current of 0.5A. The wooden former was later replaced with a steel former of the same dimension and the total flux became 800μWb.

48. Calculate flux density in the wooden former in *mT*.
A. 0.67 B. 0.76 C. 0.62 D. 0.72 E. 0.95

49. Determine the relative permeability of the steel.
A. 3293.71 B. 2339.71 C. 3921.71 D. 2393.71 E. 2933.71

50. Find the reluctance of the steel magnetic circuit in *MA/Wb*
A. 3.25 B. 0.76 C. 1.25 D. 1.76 E. 2.25

E. A. Frimpong

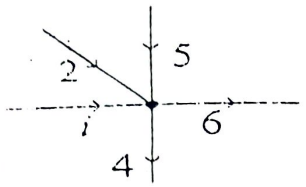
KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ENGINEERING
Mid-Semester Examination
EE 151 APPLIED ELECTRICITY

November 2012

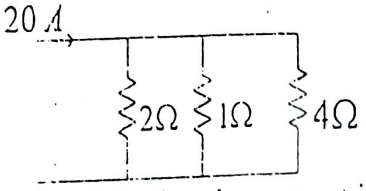
30minutes

Answer all questions by shading the correct option on the answer sheet provided

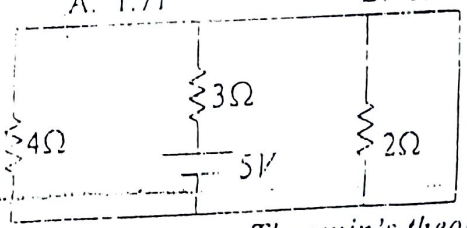
1. Consider the figure below and find the value of i in amperes.
   A. -3 B. 3 C. 6 D. -6 E. 2



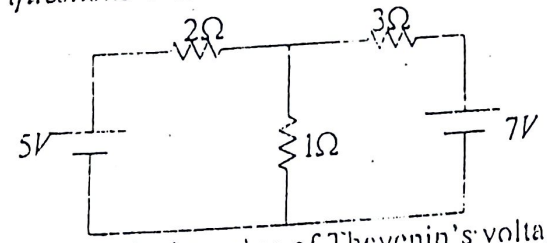
2. What is the value of the current in amperes through the 1Ω resistor of the circuit below?
   A. 11.43 B. 10.25 C. 9.05 D. 10.84 E. 12.14



3. Determine the current in amperes through the 3Ω resistor in the circuit below.
   A. 1.71 B. 0.76 C. 0.67 D. 1.67 E. 0.71

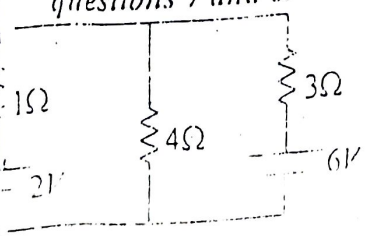


It is desire to use Thevenin's theorem to find the current in the 2Ω resistor of the circuit below. Answer questions 4-6.



4. What is the value of Thevenin's voltage in volts?
   A. 6.28 B. 2.86 C. 3.25 D. 2.01 E. 3.14
5. Find the Thevenin's resistance in ohms?
   A. 5 B. 4 C. 1.5 D. 0.75 E. 1.33
6. What is the current in the 2Ω resistor in amperes?
   A. 1.45 B. 1.54 C. 3.2 D. 0.89 E. 1.18

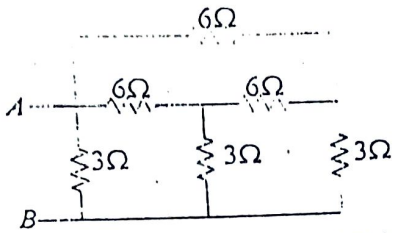
It is desired to use Norton's Theorem to find the current in the 4Ω resistor of the circuit below. Answe questions 7 and 8.



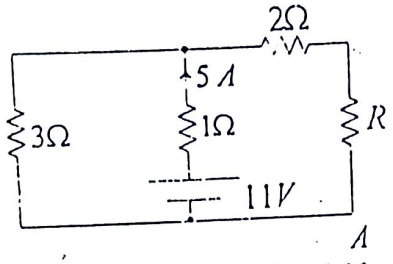
7. What is the magnitude of Norton's current?
A. 1 B. 2 C. 3 D. 4 E. 5

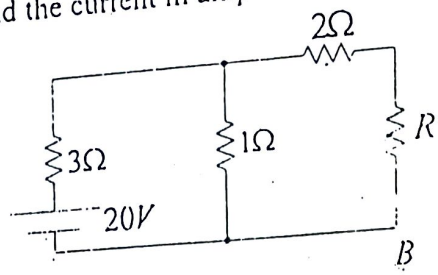
8. What is the current in the 4Ω resistor in amperes?
A. 0.84 B. 0.63 C. 0.58 D. 0.72 E. 1.03

9. What is the effective resistance between terminals A and B of the circuit below?
A. 5 B. 4.5 C. 1.8 D. 4 E. 6



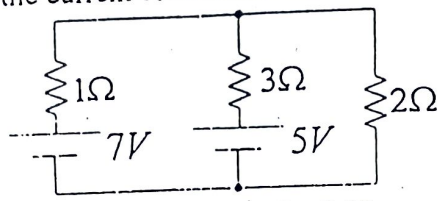
10. Consider figures A and B below and find the current in amperes in the 1Ω resistor of figure B.





A. 2.54 B. 4.11 C. 3.64 D. 6.67 E. 2.5

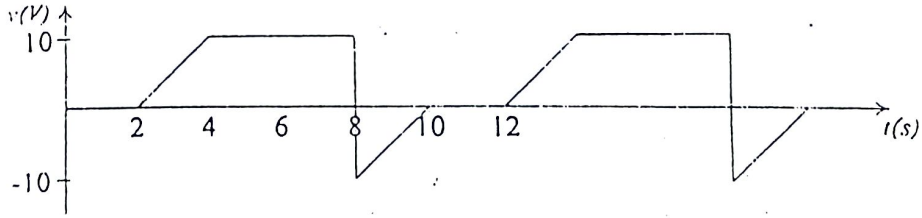
11. It is desired to use superposition theorem to find the current in the 2Ω resistor of the circuit below. Find the current contribution of the 5V battery?



A. 1.03 B. 0.98 C. 0.68 D. 1.5 E. 0.45

12. The period of a semicircular (all positive) wave of diameter 4 units is 4s. What is the average value of the wave?
A. 6.28 B. 1.57 C. 2.35 D. 1.04 E. 1.45

Answer questions 13 and 15 using the voltage waveform below.



13. What is the average value of the voltage waveform in volts?
A. 8 B. 2.75 C. 3 D. 6 E. 4

14. Determine the effective value of the waveform in volts.
A. 7.3 B. 6.8 C. 5.7 D. 8.3 E. 5.2

15. Determine the *rms* value of the voltage $v = 5 + 7\sin(wt - 10^0) + 12\sin(3wt + 15^0)$.
A. 12.02 B. 11.02 C. 10.02 D. 9.02 E. 8.02

E. A. Frimpong

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

College of Engineering

(BSc. Engineering) First Year, First Semester Examination

EE 151 APPLIED ELECTRICITY

December 2011

Time: 2½ Hours

INSTRUCTIONS

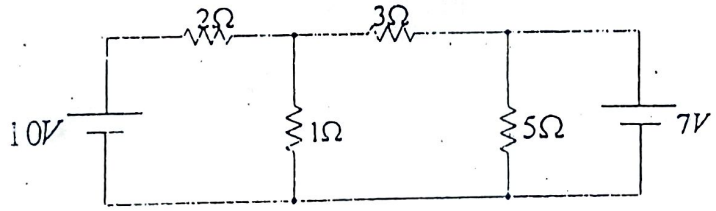
1. Answer all questions (if you can) by shading the correct option on the multiple choice answer sheet provided.
2. Make sure you shade well. The MACHINE WILL REJECT WRONG SHADINGS and this will go against you.
3. DO NOT circle, tick or mark any answer on the question paper.
4. Each correct answer will earn you 1.4marks.
5. A wrong answer will attract a penalty of -1mark.
6. Write down your answer on the question paper if you do not find it among the options provided.
7. At the end of the examination, submit both question paper and multiple choice answer sheet to the invigilator(s).

Programme_____ Index Number_____

1. Two currents $i_1 = 2t^2 - 3t + 1$ and $i_2 = 3t^2 + 2t - 5$ flow through a pure inductor of inductance 0.1H in the same direction. Determine the voltage across the inductor after 2 seconds.

   A. 1.5 B. 2.3 C. 1.9 D. 2 E. 1.75

It is desired to use Thevenin's theorem to find the current in the 3Ω resistor of the circuit below. Answer questions 2 to 4.



2. Find the value of V_{th} in volts.

   A. 1 B. 2.67 C. 3.67 D. 4 E. 1.67

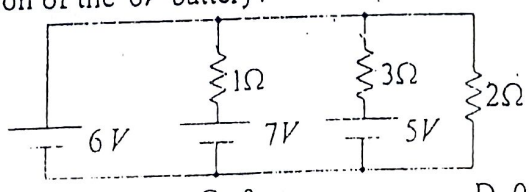
3. What is the value of R_{th} in ohms?

   A. 0.67 B. 1.67 C. 2.67 D. 3.67 E. 1

4. What is the current in the 3Ω resistor in amperes?

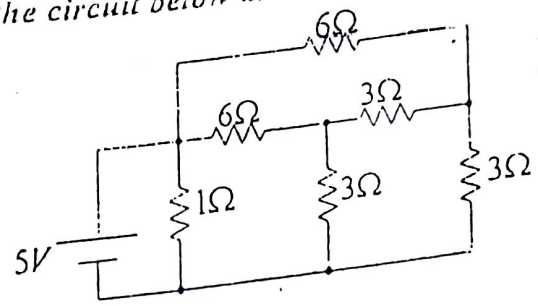
   A. 0.153 B. 2.3 C. 1.08 D. 1 E. 2.01

5. It is desired to use superposition theorem to find the current in the 2Ω resistor of the circuit below. What is the current contribution of the 6V battery?



   A. 1.25 B. 2 C. 3 D. 0.65 E. 1

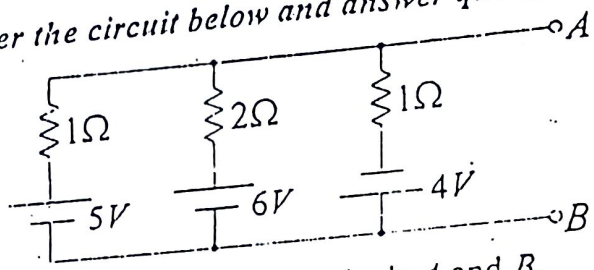
Consider the circuit below



6. Determine the total resistance of the circuit.
A. 0.72 B. 0.82 ✓ C. 0.92 D. 1.02 E. 1.12

7. Hence or otherwise, find the current in amperes in the 1Ω resistor.
A. 4 B. 3.1 C. 3.5 D. 5 ✓ E. 1.03

Consider the circuit below and answer questions 8 to 10.

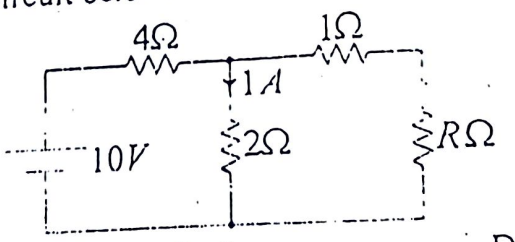


8. Find the short circuit current in amperes between terminals *A* and *B*.
A. 1 B. 2 C. 3 D. 4 ✓ E. 5

9. What is the total resistance seen between terminals *A* and *B* when all sources have been deactiva
A. 0.1 B. 0.2 C. 0. 3 D. 0.4 ✓ E. 0.5

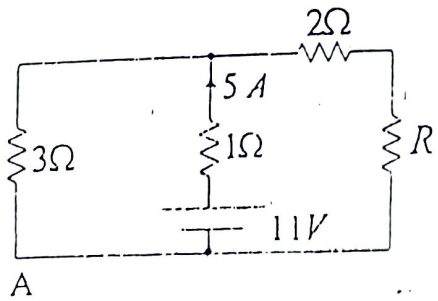
10. Hence or otherwise, determine the current in a 3Ω resistor placed between the two terminals.
A. 0.271 B. 0.371 C. 0.471 ✓ D. 0.571 E. 0.6

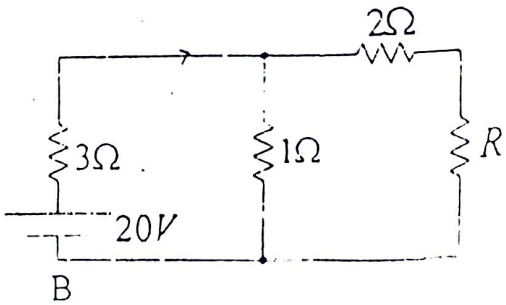
11. Determine the value of *R* in the circuit below.



A. 1 ✓ B. 2 C. 3 D. 4 E. 2

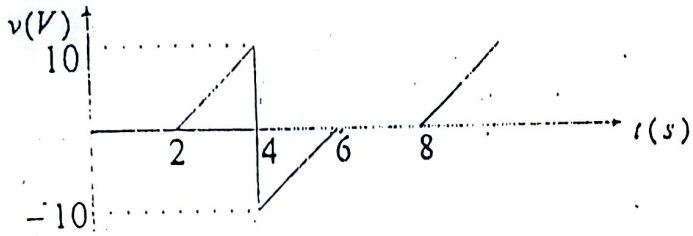
12. Consider figures A and B below and find the current in the 1Ω resistor of figure B.





A. 1.64 B. 2.64 C. 3.64 ✓ D. 4.64 E. 5.0

Consider the voltage waveform below and answer questions 13 and 14.

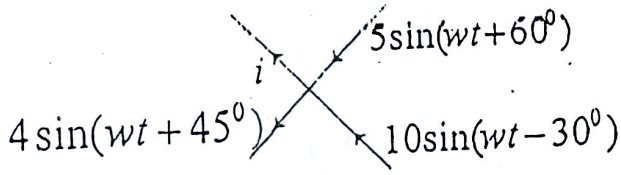


13. What is the average voltage?
A. 0.12 B. 2 C. 1.3 D. 0.23 E. 0

14. Find the effective value of the voltage waveform.
A. 3.71 B. 4.71 C. 5.71 D. 2.71 E. 1.71

15. Determine the *rms* value of the voltage $v = 5 + 7\sin(wt - 10^0) + 12\sin(3wt + 15^0)$.
A. 12.02 B. 11.02 C. 10.02 D. 9.02 E. 8.02

Consider the diagram below and answer questions 16 and 17.



16. Determine the value of the real component of i.
A. 6.33 B. 7.33 C. 8.33 D. 9.33 E. 10.33

17. What is the rms value of i?
A. 10.03 B. 9.03 C. 8.03 D. 7.03 E. 6.03

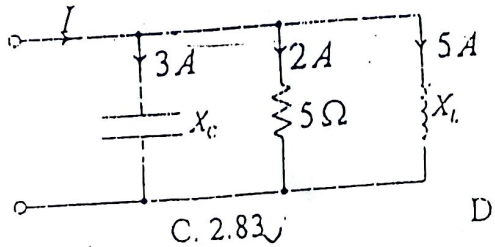
A coil of resistance 10Ω and inductance $0.1H$ is connected in parallel with a $50\mu F$ capacitor across a $200V$, $50Hz$ ac supply. Use this information to answer questions 18 to 20.

18. Determine the impedance of the circuit.
A. 16.81 B. 81.26 C. 61.82 D. 86.21 E. 62.18

19. What is the current in the coil?
A. 3.066 B. 4.066 C. 5.066 D. 6.066 E. 7.066

20. What is the lagging power factor of the circuit?
A. 0.754 B. 0.396 C. 0.496 D. 0.475 E. 0.572

21. Find the value of I in the circuit below.



A. 0.83 B. 1.83 C. 2.83 D. 3.83 E. 4.83

An emf whose instantaneous value at time t is $300\sin(314t + \pi/6)$ *volts is applied to a capacitive circuit and the current in the circuit is* $7.5\sin(314t + \pi/3)$ *amperes. Answer questions 22 to 24.*

22. Determine the resistance of the circuit in ohms.
A. 34.64 B. 43.64 C. 30.64 D. 43.46 E. 18.32

23. What is the capacitance of the capacitor in microfarad?
A. 169.15 B. 159.15 C. 149.15 D. 139.15 E. 129.15

24. Calculate the power in watts absorbed by the resistor.
A. 749.28 B. 824.79 C. 428.97 D. 974.28 E. 794.82

A fan rated, 1kVA 0.7pf lagging, a heater rated 2kW and a capacitive load rated 1.25kVA, 0.85pf leading are connected across a 220V, 50Hz supply. Answer questions 25 to 28.

25. Determine the total active power in *kW* taken by the loads.
A. 3.7625 B. 5.3762 C. 6.2537 D. 7.2563 E. 5.2673

26. Calculate the total reactive load in *kVAr* drawn from the supply.
A. 0.075 B. 5.557 C. 6.554 D. 0.056 E. 0.0032

27. What is the total current in amperes drawn from the supply?
A. 16.1 B. 17.1 C. 18.1 D. 15.1 E. 14.1

28. Find the lagging power factor of the load.
A. 0.8888 B. 0.7777 C. 0.6667 D. 0.9999 E. 0.5555

29. The supply voltage across and the current through a load are $(20 + j5)V$ and $(4 - j3)A$ respectively. What is the lagging power factor of the load?
A. 0.63 B. 0.53 C. 0.73 D. 0.83 E. 0.753

A balanced star connected load of $(20 - j40)\Omega$ *per phase is connected in parallel with a balanced delta connected impedance of* $(30 + j63)\Omega$ *per phase across a 415V three-phase supply. Answer questions 30 to 32.*

30. Determine the current in amperes in the red phase.
A. 7.17 B. 5.15 C. 6.17 D. 9.19 E. 8.18

31. What is the lagging power factor of the combined load?
A. 0.734 B. 0.934 C. 0.834 D. 0.634 E. 0.534

32. What is the total power in *W* drawn from the supply?
A. 2903.74 B. 3903.74 C. 4903.74 D. 5903.75 E. 6903.7

A three-phase motor which produces an output of 3.6*kW* at efficiency of 90% and a power factor of 0.75 lagging is connected to a three-phase 400*V* supply. Answer questions 33 to 35.

33. Determine the reactive power in *kVAr* consumed by the motor.
A. 3.527 B. 4.527 C. 4.153 D. 2.527 E. 5.134

34. Calculate the apparent power in kVA drawn from the supply.
A. 6.333 B. 5.333✓ C. 4.333 D. 7.333 E. 8.313

35. What is the motor line current in amperes?
A. 3.698 B. 4.698 C. 5.698 D. 6.698 E. 7.698✓

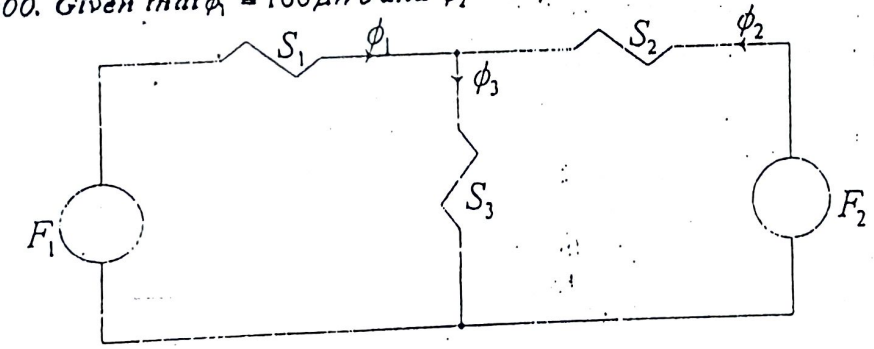
The following single-phase loads are connected to a 415V three-phase supply: $Z_R = (50 - j20)\Omega$, $Z_Y = (50 + j10)\Omega$ *and* $Z_B = (30 + j5)\Omega$. *Answer questions 36 to 37.*

36. What is the current in amperes in the yellow phase?
A. $4.7\angle -131.3^0$✓ B. $5.7\angle -131.3^0$ C. $3.7\angle -131.3^0$ D. $3.9\angle -101.3^0$

37. Find the magnitude of the current in the neutral conductor in amperes.
A. 7.77 B. 6.77 C. 5.77✓ D. 4.77 E. 3.77

38. Three resistive single-phase loads draw the following currents from a three-phase supply: $I_1 = 5A$, $I_2 = 8A$ and $I_3 = 4A$. What is the magnitude of the neutral current?
A. 2.61 B. 3.61✓ C. 4.61 D. 5.61 E. 7.61

The equivalent circuit of a magnetic core of a uniform cross sectional area of $1.5cm^2$ *is shown below. The lengths associated with reluctances* S_1, S_2 *and* S_3 *are* $0.15m, 0.2m$ *and* $0.25m$ *respectively. The number of turns required to produce each mmf is 100 and the relative permeability of the core is 3000. Given that* $\phi_1 = 100\mu Wb$ *and* $\phi_2 = 80\mu Wb$ *answer questions 39 to 43.*



39. Find the value of ϕ_3 in μWb.
A. 150 B. 200 C. 210 D. 130 E. 180✓

40. Determine the value of S_2 in AT/Wb.
A. 635377.6513 B. 533767.6513 C. 335677.6513 D. 353677.6513✓ E. 44105.1

41. Find the value of F_1 in ampere-turns.
A. 103.1 B. 105.1 C. 104.1 D. 106.1✓ E. 107.1

42. Find the value of F_2 in ampere-turns.
A. 105.9 B. 106.9 C. 107.9✓ D. 104.9 E. 102.9

43. Determine the current in coil 1 in amperes.
A. 1.071 B. 1.061 C. 1.041✓ D. 1.051 E. 1.031

44. A magnetic circuit comprises two parts A and B in series. If the flux density in part A is $0.3T$ and the cross sectional areas of parts A and B are $50cm^2$ and $70cm^2$ respectively, find the flux density in part B.

A. 0.52 B. 0.42 C. 0.32 D. 0.22 E. 0.62

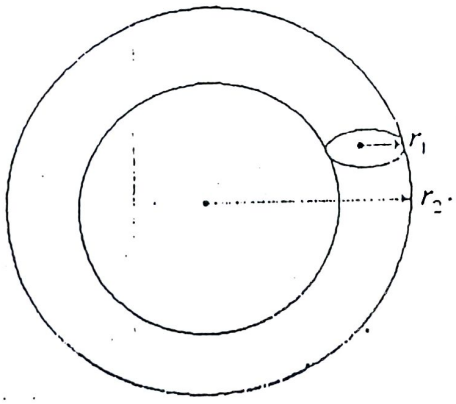
45. A magnetic circuit of length $0.5m$ has a coil of 2000 turns. Determine the intensity of the magnetic field if the current in the coil is $60mA$.

A. 240 B. 235 C. 230 D. 245 E. 253

46. A rectangular magnetic core of a uniform cross sectional area of $1.4cm^2$ has an air gap. Determine the length in cm of the air gap which produces a magnetomotive force drop of $20AT$. The flux in the circuit is $0.05\mu Wb$.

A. 5 B. 6 C. 7 D. 8 E. 9

A 2000-turn coil carrying a current of 0.3A is wound on the circular wooden former shown below where $r_1 = 1cm$ and $r_2 = 5cm$. Use this information to answer questions 47 to 48.



47. Determine the flux density in T in the wooden former.

A. 0.0034 B. 0.0024 C. 0.014 D. 0.043 E. 0.044

48. What is the flux in the wood in μWb ?

A. 13.8 B. 13.5 C. 4.4 D. 0.75 E. 1.07

If for the same coil turns and current, the flux became 550μWb when the circular wooden former above (for questions 47 and 48) was replaced with an iron former of the same dimension, answer questions 49 and 50.

49. What is the relative permeability of the iron?

A. 629.58 B. 529.58 C. 729.58 D. 929.58 E. 829.5

50. Calculate the reluctance of the magnetic circuit in AT/Wb with the iron former.

A. 1090909 B. 1080808 C. 1040404 D. 1060606 E. 1050

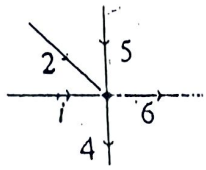
E. A. Frimpong

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ENGINEERING
Mid-Semester Examination
EE 151 APPLIED ELECTRICITY

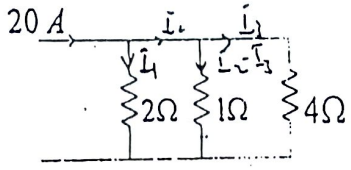
November 2010 1 Hour

Answer all questions by shading the correct option on the multiple choice answer sheet provided

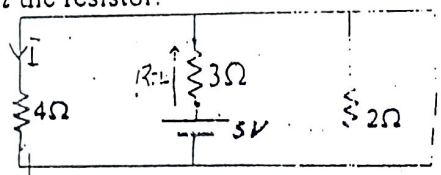
1. Find the value of i.
   A. -3A
   B. 3A
   C. 6A
   D. -6A
   E. 2A



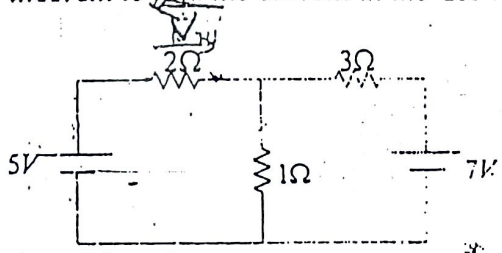
2. What is the value of the current in the 1Ω resistor?
   A. 10.517A
   B. 9.25A
   C. 11.429A
   D. 10.157A
   E. 12.014A



3. Determine the current in 3Ω the resistor.
   A. 1.67A
   B. 1.154A
   C. 0.714A
   D. 1A
   E. 0A

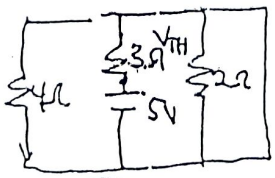


It is desired to use Thevenin's theorem to find the current in the 2Ω resistor of the circuit below. Answer questions 4-6.



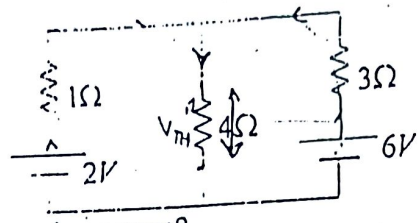
4. What is the value of Thevenin's voltage?
   A. 3.25
   B. 2.13
   C. 2.93
   D. 2.01
   E. 4.9

5. Find the Thevenin's resistance?
   A. 4
   B. 0.53
   C. 1.2
   D. 1.25
   E. 0.75



6. What is the current in the 2Ω resistor?
   A. 1.45
   B. 1.54
   C. 1.18
   D. 0.89
   E. 1.25

It is desired to use Norton's Theorem to find the current in the 4Ω resistor of the circuit below. Answer questions 7 – 9.

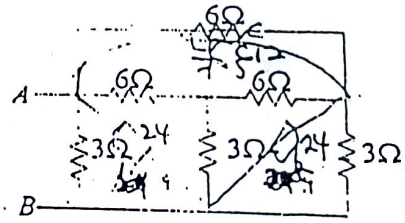


7. What is the magnitude of Norton's current?
   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

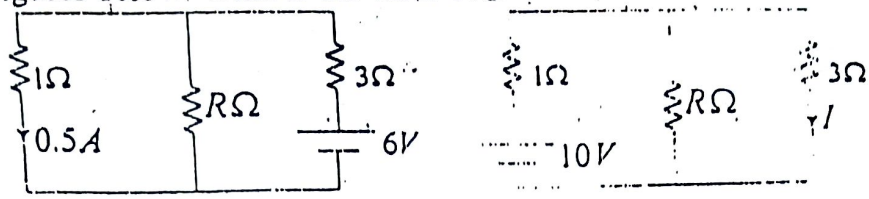
8. What is the value of Norton's resistance?
   A. 1.25
   B. 0.75
   C. 1.24
   D. 1.11
   E. 1.2

9. What is the current in the 4Ω resistor?
   A. 1.2
   B. 2.1
   C. 0.63
   D. 0.53
   E. 0.89

10. What is the effective resistance between terminals A and B of the circuit below?
   A. 1.8
   B. 1.4
   C. 2.5
   D. 3.2
   E. 0.896

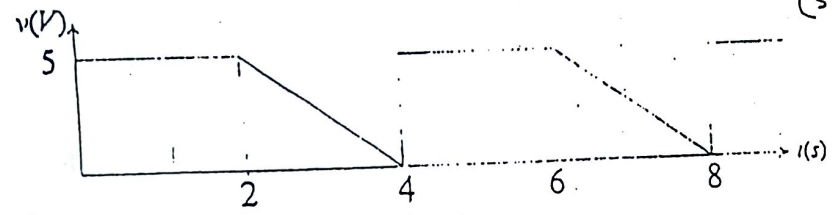


11. Consider the figures below. What is the value of i?



A. 0.89
B. 0.83
C. 1.25
D. 0.53
E. 2.12

Consider the function below and answer questions 12 and 13



12. What is the average value of the function?
A. 4.52
B. 3.75
C. 2.54
D. 4.25
E. 3.42

13. What is the root mean square value?
A. 4.25
B. 4.12
C. 4.08
D. 4.08
E. 3.42

Use the information below to answer questions 14 and 15.

A circuit element is fed from three alternating current sources: are: $i_1 = 10\sin wt$, $i_2 = 5\sin(wt$

and $i_3 = 15\cos(wt + 30^0)$

14. Determine the *rms* value of the current through the element.
A. 22.42
B. 21.97
C. 17.13
D. 10.64
E. 13.25

15. If the voltage across the element is $50\sin(\omega t - 10^0)$, what is the phase angle in degrees between the current and the applied voltage?
A. 35.67
B. 15.67
C. 45.67
D. 25.67
E. None of the above

Use the information below to answer questions 16-19

A coil having a resistance of 5Ω and an inductance of 0.1H is connected in series with a capacitor of capacitance $100\mu F$. The supply voltage across the elements is $200sin100\pi t$.

$R = 5\Omega$ $\quad V = 200\sin 100\pi t$

$I = 0.1$

$C = 100\ \mu F$

$X = 1X$

$Z = R(1+X)$

$= 5(0.1+100)$

16. What is the impedance of the coil?
    A. 33.64
    B. 32.97
    C. 33.12
    D. 32.12
    E. 31.82

17. Determine the rms value of the current through the circuit.
    A. 39.84
    B. 28.17
    C. 21.48
    D. 19.06
    E. 10.004

18. What is the phase angle between the current and the supply voltage?
    A. 2.15
    B 5.12
    C 3.5
    D. 4.69
    E. 3.25

19. What is the relationship between the current and supply voltage?
    A. Voltage is lagging current
    B. Voltage is leading current
    C. Voltage is in phase with current
    D. Current is out of phase with voltage
    E. The is no phase angle between them

20. Determine the *rms* value of the wave given by: $3 + 10\sin\omega t + 5\sin 2\omega t$.
    A. 8.456
    B. 9.175
    C. 6.44
    D. 5.41
    E. 7.214

$a_0 + a_2$

$\sqrt{3^2 + \sqrt{\frac{10}{2}}}$

E. A. Frimpong

A B C D E F G H I J

10 4 11 2 8 1 9 6 5 12

K L M N O P Q R

7 2 13 24 16 20 17 25

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ENGINEERING
First Year, First Semester Examination

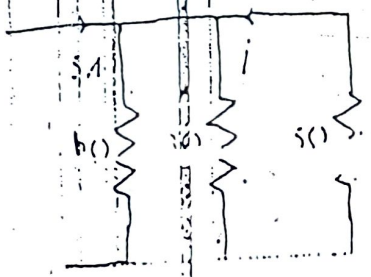
EE 151 APPLIED ELECTRICITY

December, 2009 — 2½ HOURS

Answer ALL questions by circling the correct option

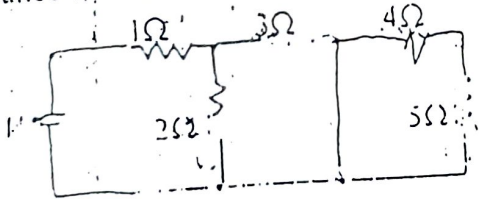
1. The current through a 100mH inductor is given by: $i(t) = 5t^2 + 1$. Find the voltage across the inductor at time $t = 5$.
   A. 300V
   B. 8.105V
   C. 3V
   D. 5.35V

2. Determine the value of current i in the circuit below.



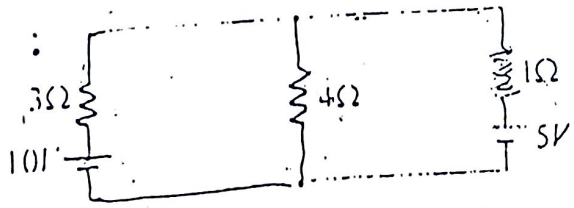
   A. – 0.968
   B. + 1.875
   C. 1.875
   D. 0.968

3. Find the equivalent resistance of the circuit below.



   A. 1.23
   B. 2.2
   C. 3.5
   D. 4.15
   E. 7.205

Use the circuit below to answer questions 4 to 6.



4. With the 10V source acting alone, determine the current in the 4Ω resistor.
   A. 0.526
   B. 0.427
   C. 1.053
   D. 2.014

16. If the supply voltage is $10\sin(\omega t - 20°)$, calculate the power factor of the circuit.
A. 0.86 leading
B. 0.98 leading
C. 0.86 lagging
D. 0.98 lagging

17. The current in a circuit, $i = 5\sqrt{2}\sin\omega t + 10\sin(2\omega t + 30°) + 8\sin(4\omega t - 45°)$. determine the peak value of the current.
A. 107A
B. 10.34A
C. 14.63A
D. 9.01A

Use the information below to answer questions 18 and 19.

The efficiency of a single-phase motor connected to a 240V, 50Hz supply is 80%. The output power of the motor is 2kW when drawing a current of 15A.

18. Calculate the power factor of the motor.
A. 0.725
B. 0.813
C. 0.583
D. 0.694

19. Determine the reactive power consumed by the motor.
A. 2510VAr
B. 2590VAr
C. 3620VAr
D. 1800VAr

20. The supply voltage and current of a circuit are $50 + j10$ and $5 - j0$ respectively. Find the reactive power consumed.
A. 240VAr
B. 0VAr
C. 100VAr
D. 260VAr

Answer questions 21 to 24 using the information provided below.

A single-phase installation comprises (i) A 1kVA load at a power factor of 0.6 lagging. (ii) A 500W purely resistive load, and (iii) 3 compact florescent lamps each at 20W, 0.95 power factor lagging. The installation draws power from a 230V, 50Hz supply.

21. Determine the installation's total active power.
   A. 1210W
   B. 1170W
   C. 3200W
   D. 2215W

22. Calculate the total apparent power of the installation.
   A. 1563.16VA
   B. 1170VA
   C. 1439.16VA
   D. 2071.97VA

23. Find the power factor of the installation.
   A. 0.84 leading
   B. 0.84 lagging
   C. 0.48 leading
   D. 0.48 lagging

24. Determine the current drawn from the supply
   A. 9A
   B. 6.26A
   C. 10A
   D. 7.8A

25. Which of the following statements is false?
   A. Single-phase motors are simpler than three-phase motors
   B. Three-phase generators are cheaper than single-phase generators
   C. The voltage regulation of three-phase systems is better than single-phase systems
   D. Single-phase generators are less efficient than three-phase ones

26. Which of the following is not a positive phase sequence?
   A. abc
   B. RBY
   C. RYB
   D. 123

Answer questions 27 and 28 using the information below.

Three identical 40Ω purely inductive loads are connected in star across a 3-phase 415V supply.

27. Calculate the line current.
    A. 10.375∧
    B. 15∧
    C. 6∧
    D. 5.01∧

28. Calculate the power absorbed by the load.
    A. 4320W
    B. 0W
    C. 15W
    D. None of the above

Use the information below to answer questions 29 to 34

A delta-connected load of $30 - j15$ per phase is connected in parallel with a star-connected load of $3 + j12$ per phase. The supply voltage is 415V.

29. Calculate the line current.
    A. 25.58∧
    B. 34.015∧
    C. 20.39∧
    D. 18.87∧

30. Determine the overall power factor.
    A. 0.875 leading
    B. 0.875 lagging
    C. 0.933 lagging
    D. 0.933 leading

31. Calculate the power taken from the supply
    A. 1500W
    B. 1634W
    C. 20013W
    D. 17155W

Use the information below to answer questions 32 to 35.

A star-wound manufacturing plant draws 5MVA from an 11kV, 3-phase line. The power factor of the plant is 0.85 lagging.

32. Find the line current.
   A. 400A
   B. 787.30A
   C. 454.55A
   D. 262.43A ✓

33. Calculate the plant impedance per phase.
   A. 21.5Ω
   B. 23.30Ω
   C. 24.2Ω ✓
   D. 23.7Ω

34. Find the magnitude of the neutral current.
   A. 2A
   B. 0A
   C. 3A
   D. None of the above

35. Determine the reactive power consumed by the load.
   A. 2633913.44VA ✓
   B. 3234520.10VA
   C. 5780003VA
   D. 1869498.35VA

Answer questions 36 to 38 using the information below.

The loads of a 400V, 3-phase system are 5kW, 4kW and 2.5kW.

36. Calculate the current taken by the 5kW load.
   A. 19.23A
   B. 23.54A
   C. 21.65A
   D. 22.12A

37. Find the magnitude of the neutral current.
   A. 2A
   B. 3.75A
   C. 4.32A
   D. 5A

38. What is the power factor of the system?
A. 0
B. 0.5 lag
C. 0.866
D. 1

39. Which of the following materials has the highest relative permeability?
A. Wood
B. Paper
C. Iron
D. Steel

40. Which of the following statements is not true about electric and magnetic circuits?
A. MMF is similar to electromotive force
B. Resistance is similar to reluctance
C. Flux density is similar to current
D. Permeance is similar to conductance

Use the information below to answer questions 41 to 43.

A magnetic circuit has a coil of 500 turns and flux density of 2.2 T. The cross sectional area of the core and length of flux path is $10cm^2$ and $50cm$ respectively. The current through the coil is 5A.

41. Calculate the magnetic field intensity.
A. 416.67
B. 334.54
C. 450
D. 523.23

42. Calculate the reluctance of the magnetic circuit.
A. 545.21
B. 683.48
C. 638.48
D. 757.58

43. Given that absolute permeability is $4\pi \times 10^{-7}$, find the relative permeability of the magnetic core.
A. 4202
B. 4200
C. 3000
D. 3906

Answer questions 44 to 46 using the information below.

A magnetic circuit comprises an iron core of length 50*mm* and cross sectional area 40*mm*^{2} in series with an air gap of length 0.6mm and cross sectional area 40*mm*^{2}. A coil of 200 turns is wound on the iron former and the flux density in the air gap is 0.4 T. It is assumed that there is no flux leakage. The relative permeability of the iron is 3000.

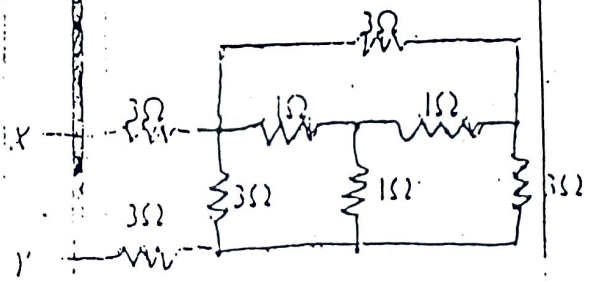
44. Calculate the mmf in the iron core.
    A. 5.31AT
    B. 57.31AT
    C. 19.04AT
    D. 39.57AT

45. Calculate the total magnetomotive force.
    A. 96.63AT
    B. 69.36AT
    C. 93.63AT
    D. 196.3AT

46. Calculate the current in the coil.
    A. 0.468A
    B. 0.98A
    C. 0.483A
    D. 0.83A

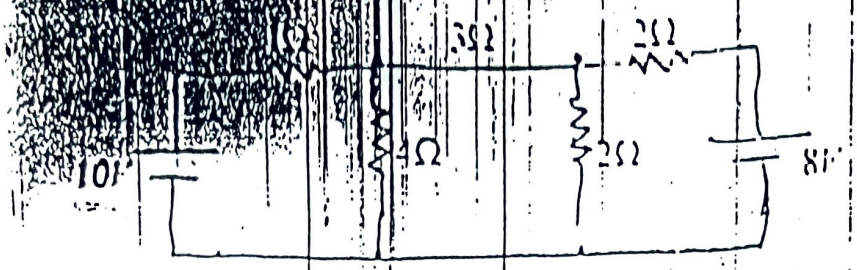
47. Determine the total resistance between terminals X and Y in the circuit below.

    A. 6Ω
    B. 7 Ω
    C. 8 Ω
    D. 9.5 Ω



It is desired to use Thevenin's theorem to solve for the current in the 3Ω resistor.

Use the circuit below to answer questions 48 to 50



48. Calculate the Thevenin's voltage
    A. 10V
    B. 14V
    C. 12V
    D. 13V

49. Determine the Thevenin's equivalent resistance.
    A. 1.8
    B. 0.44
    C. 2.35
    D. 1.42

50. Find the current through the 3Ω resistor.
    A. 5.1A
    B. 0.983A
    C. 3.21A
    D. 2.5A

A. Frimpong