



COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY

School of Electrical & Electronics Engineering

Bachelor of Engineering (Honours)

EEB501 – Introduction to Electrical & Electronics Engineering

FINAL EXAMINATION

Semester 2, 2019

Date: As per Exam Timetable

Time: As per Exam Timetable (3 hours & 10 minutes)

Venue: As per Exam Timetable

Instructions to Students

1. You are allowed an extra ten (10) minutes of reading time during which you are NOT allowed to write.
2. Attempt ALL questions in this examination booklet
3. Write your answers in the answer booklet provided.
4. Write your Student ID number on each page used.
5. Begin each Section on a fresh page and use both sides of the answer sheet.
6. You may use calculators provided they are non-programmable.
7. Clearly number the questions in your answer paper in their correct sequence and write legibly. Show all working.
8. Attach any extra sheets used to your answer booklet securely with the string provided.

Question 1 [40 marks]

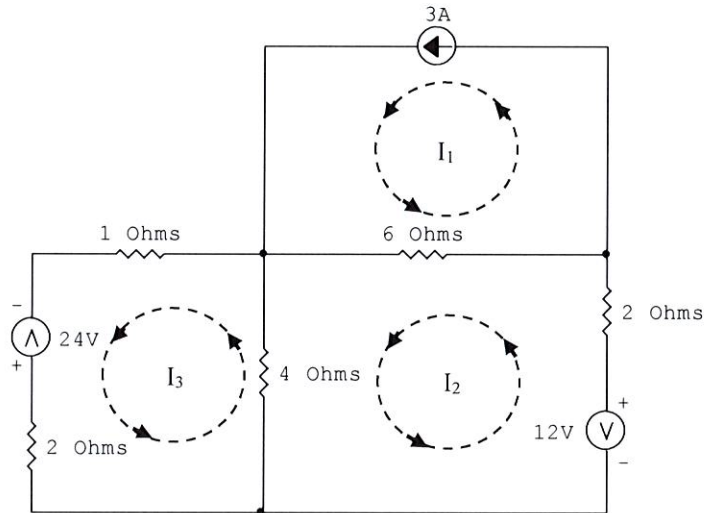
- a) Briefly explain two types of errors in measurements. [2 marks]
- b) Briefly explain the Kirchhoff's voltage and current laws. [2 marks]
- c) Explain the advantages of 3-phase system over the single phase system. [2 marks]
- d) Name the device used to measure power. [1 mark]
- e) State at least two characteristics of an ideal op-amp. [2 marks]
- f) Draw a fully labelled circuit diagram of an inverting amplifier showing the input output relationship if a sinusoidal signal is applied to the input. [3 marks]
- g) Draw the symbols of:
 - i. p-channel JFET
 - ii. LED
 - iii. SCR
 - iv. NOR gate[4 marks]
- h) Show the truth table for the 2-input NAND gate. [2 marks]
- i) With the aid of diagrams, explain the operation of a PN junction. [3 marks]
- j) Show how you can utilize a 5V DC output to control a 24V DC motor driven by a 24V DC supply using a NPN bipolar junction transistor. State any assumptions made. [4 marks]
- k) Draw a full wave bridge rectifier circuit and show the path of the current for the positive and negative cycles. Also draw the input and output waveforms of the circuit with and without the smoothing capacitor. [5 marks]
- l) Draw the circuit diagram for the Boolean expression $X = \overline{ABC} + B\overline{C}$ [3 marks]
- m) A lightning bolt carried a current of 1.45 kA and lasted for 5 ms. How many coulombs of charge were contained in the lightning bolt? [2 marks]
- n) The power rating of the appliances and average duration for which they are used in a day are given below for a domestic household. Calculate the electricity bill for a month (31 days) if the cost of electricity is 33.10 cents per kWh and VAT is charged at a rate of 9%. [5 marks]

Appliance	Rating	Usage	Appliance	Rating	Usage
TV	65W	6 hours	Lights	120W	10 hours
Freezer	100W	12h	Iron	1700W	0.25 hours
Laptop	60W	3 hours	Air conditioner	1200W	4 h
Mobile phone	2W	5 hours	Radio	40W	2 hours

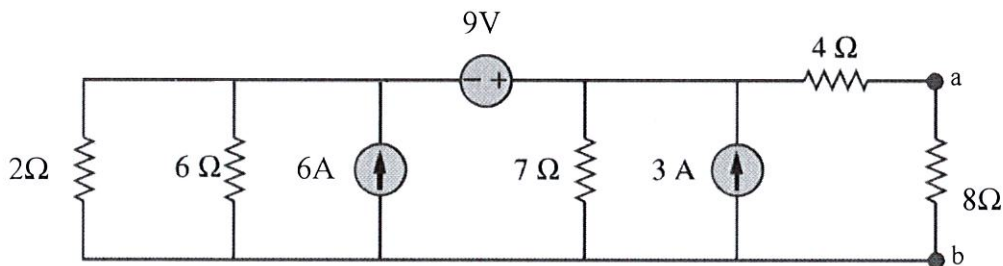
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Question 2 [30 marks]

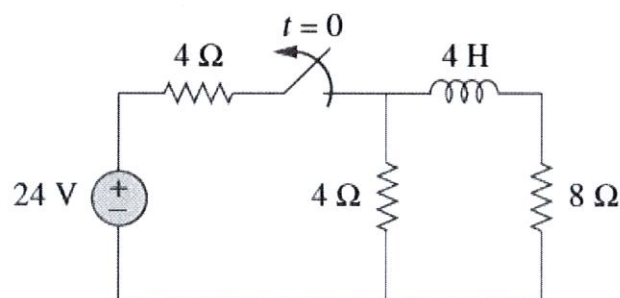
- a) Use mesh analysis to determine the power dissipated by the 6Ω resistor. [10 marks]



- b) Use Thevenin's theorem to calculate the current flowing through the 8Ω load resistor. [10 marks]



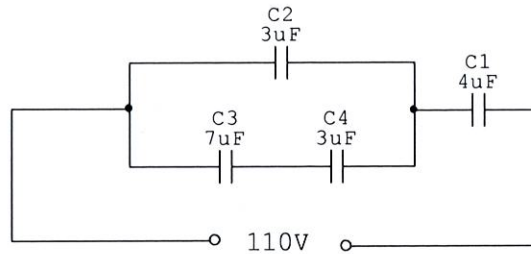
- c) The switch in the circuit given below has been closed for a long time, and is opened at $t = 0$. Find the voltage drop across the 4Ω resistor at $t = 0.38s$. [10 marks]



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Question 3 [12 marks]

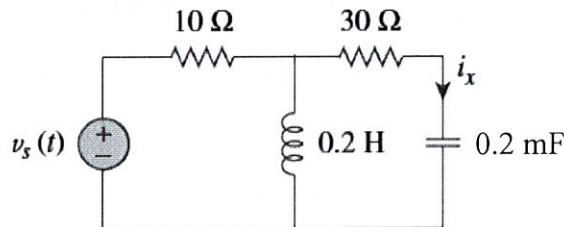
- a) Analyze the circuit given below to determine the energy stored in C4. [6 marks]



- b) Given a 3.4 W Zener diode having a reverse breakdown voltage of 5.2 V and a power source of 12.0 V:
- Show how you will construct a 5.2 V power supply (show all calculations). [4 marks]
 - Calculate the total current when a load of 0.28 kΩ is connected. [2 marks]

Question 4 [18 marks]

- a) Assuming that $v_s = 20 \cos(300t - 40^\circ)$ V in the circuit given below, determine the power factor of the circuit and the current flowing through the capacitor. [10 marks]



- b) In a balanced three-phase Y-Y system, the source is an abc sequence of voltages and $V_{an} = 100 \angle 30^\circ \text{ V}$ rms. The line impedance is $5 - j2 \Omega$ and the per-phase impedance of the load is $10 + j8 \Omega$. Calculate the line currents and the load voltages. [8 marks]

THE END