



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, 2018

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 [20 marks]

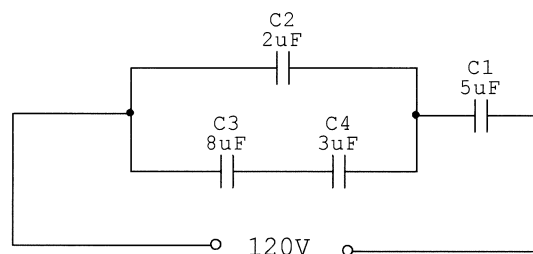
- a) List the two basic types of measuring instruments and briefly explain their advantages and disadvantages. [4 marks]
- b) With the aid of diagrams, briefly explain the Kirchhoff's laws. [4 marks]
- c) Draw the symbols of:
 - i. n-channel JFET
 - ii. photodiode
 - iii. LED
 - iv. XOR gate [4 marks]
- d) Show the truth table for the 2-input NOR gate. [2 marks]
- e) With the help of circuit diagrams, explain how an SCR can be turned ON and OFF. [4 marks]
- f) If an electron beam in a TV picture tube carries 10^{14} electrons/second and is passing through plates maintained at a potential difference of 11kV, calculate the power in the beam. [2 marks]

Question 2 [12 marks]

- a) 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	80W	3 hours	Lights	100W	8 hours
Radio	60W	4 hours	Iron	1500W	0.5 hours
Laptop	60W	3 hours	Fan	60W	3 h
Mobile Charger	5W	3 hours	Freezer	120W	12h

- b) Analyze the circuit given below to determine the charge in capacitor C2. [7 marks]



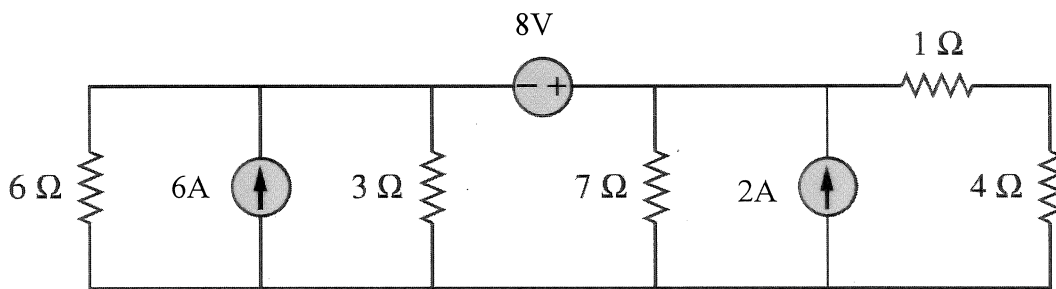
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Question 3 [14 marks]

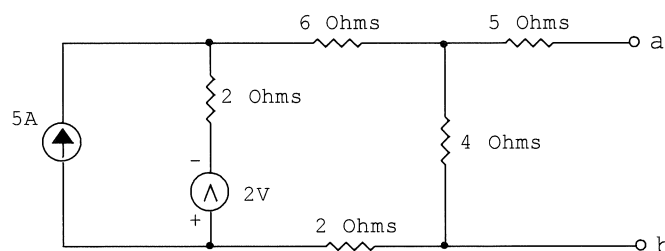
- a) Show how you can utilize a 5V DC output to control a 12V DC motor driven by a 12V DC supply using a pnp bipolar junction transistor. State any assumptions made. [4 marks]
- b) Suppose the 12V DC supply in part (a) gets burnt out and you manage to find a 24V DC power supply, a 1N5349B Zener diode ($V_z = 12V$, $P_D = 5W$) and some resistors (1k Ω , 680 Ω , 220 Ω , 30 Ω , 25 Ω , 10 Ω) from the stores. Show with the aid of circuit diagram how you can utilize these to drive the motor in part (a). Show all necessary calculations. [4 marks]
- c) Draw a fully labelled characteristic curve of a pn junction (for both Silicon and Germanium on the same plot) and with the aid of diagrams briefly explain the operation of pn junction in forward and reverse biased modes. [6 marks]

Question 4 [28 marks]

- a) Use source transformation to determine the power dissipated by the 7 Ω resistor. [8 marks]

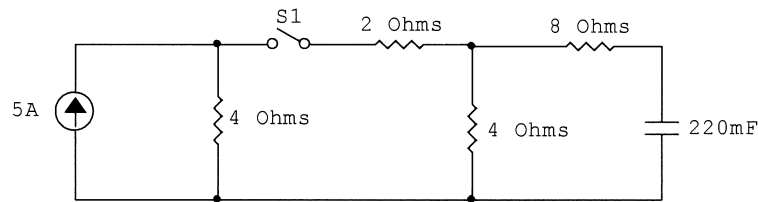


- b) Use Thevenin's theorem to calculate the current flowing through the load resistor if a load of 12 Ω is connected between points a and b. [10 marks]



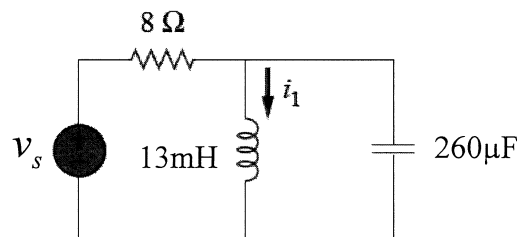
- c) The switch S1 in the circuit given on the next page has been closed for a long time, and is opened at $t = 0$. Find the voltage drop across the 4 Ω resistor at $t = 0.38s$. [10 marks]

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Question 5 [18 marks]

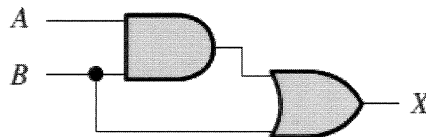
- a) Assuming that $v_s = 40 \sin(385t + 20^\circ)$ V in the circuit given below, determine the power factor of the circuit and the current i_1 flowing through the inductor. [10 marks]



- b) In a wye-delta three phase circuit the source is a balanced, abc sequence with $V_{an} = 120 \angle 0^\circ$ V . It feeds a balanced load with $Z_\Delta = 9 + j12 \Omega$ per phase through a balanced line with $Z_l = 1 + j0.5 \Omega$ per phase. Calculate the phase voltages and phase currents in the load. [8 marks]

Question 6 [8 marks]

- a) State at least two characteristics of a practical operational amplifier. [2 marks]
- b) Draw the circuit diagram of a non-inverting amplifier, state the equation for its gain and show the input-output relationship if a sinusoidal signal is applied to the input. [4 marks]
- c) Determine the Boolean expression for the circuit given below. [2 marks]



THE END