



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE
IN ELECTRICAL AND ELECTRONICS ENGINEERING

SUPPLEMENTARY EXAMINATION

ELECTRICAL CIRCUIT -1

DATE: 30/8/2017

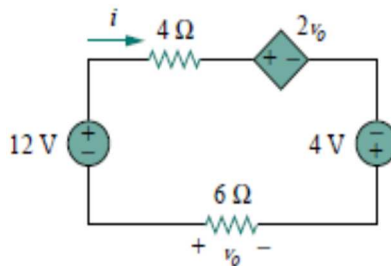
TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

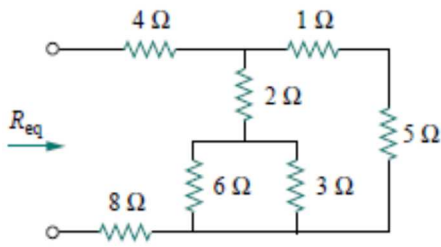
Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY)

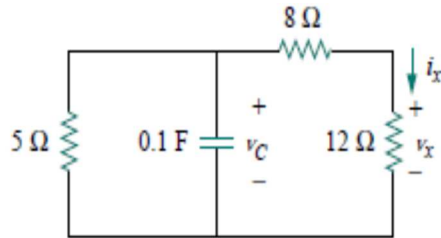
- The total charge entering a terminal is given by $q = 5t \sin 4\pi t$ mC. Calculate the current at $t = 0.5$ s. (2 marks)
- Electrical equipment in an office takes a current of 13A from a 240V supply. Estimate the cost per week of electricity if the equipment is used for 30 hours each week and 1kWh of energy costs 13.56p (2 marks)
- Distinguish between ideal independent and an ideal dependent source hence state four types of ideal dependent source. (3 marks)
- Explain briefly what is meant by open circuit and short circuit (2 marks)
- Determine v_0 and i in the circuit given below (3 marks)



- For the given below circuit, the total equivalent resistance (4 marks)

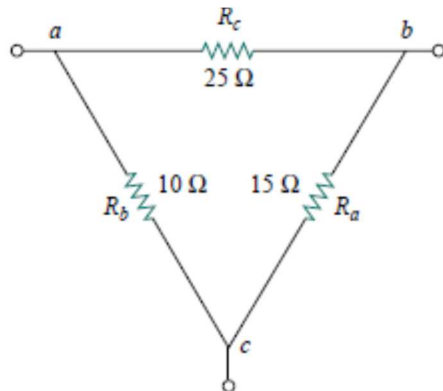


- g) i) Explain how a supermesh and super node are formed in a circuit. (2 marks)
 ii) Describe the various step devised to obtain the solution for mesh current and branch current in a circuit. (6 marks)
 iii) The current through a 0.1 H inductor is $i(t) = 10te^{-5t}$ A . Find the voltage across the inductor and the energy stored in it. (2 marks)
 iv In the figure below find V_C , V_X and i_x for $t > 0$. Assume $V_C(0) = 15V$ (4 marks)

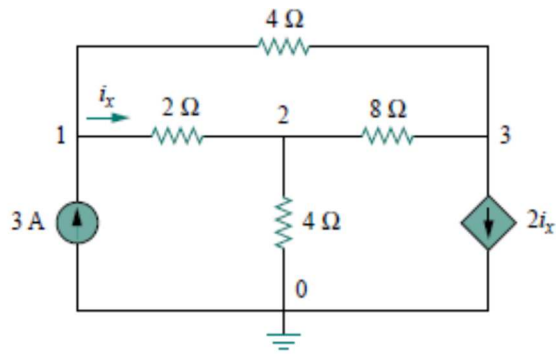


QUESTION TWO(20Marks)

- a) Two batteries A and B with internal resistance R_A and R_B are properly connected in parallel to supply a current of 160 A to a load resistance R_L . Given that $E_A = 120V$, $R_A = 0.15\Omega$, $R_B = 0.1\Omega$ and $I_B = 60A$. calculate i) E_B ii) and the load power. (6 marks)
 b) Derive an expression for delta to wye and wye to delta conversion hence solve for the below circuit Δ to Y conversion (8 marks)

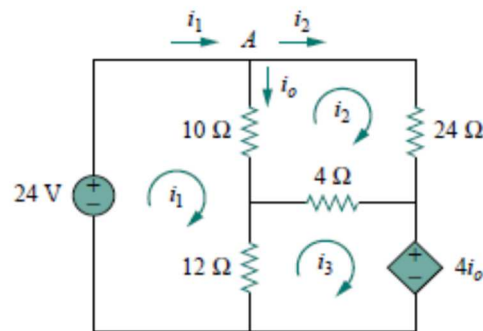


- c) Determine the nodal voltages in the given below circuit (6 marks)

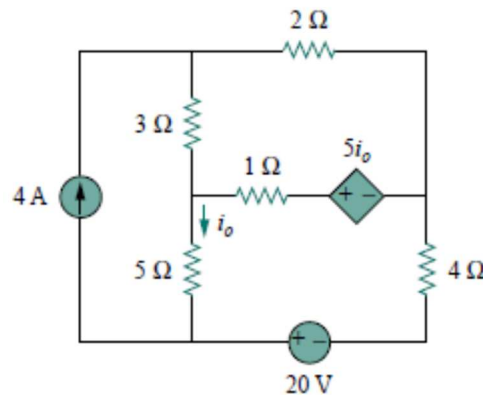


QUESTION THREE(20Marks)

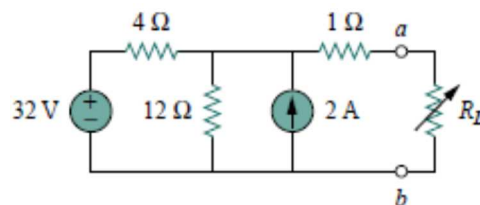
- a) In the given figure below, determine i_o using mesh analysis (6 marks)



- b) Find i_o in the given circuit using superposition (8 marks)

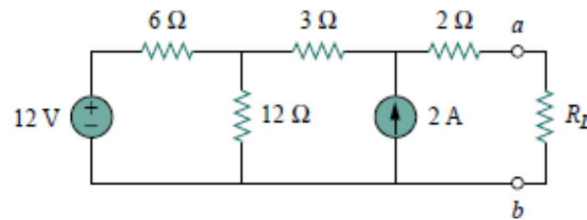


- c) Distinguish between Norton and Thevenin theorem hence solve for the given circuit using Thevenin theorem from left terminal a-b also find the current through $R_L=8\Omega$ (6 marks)

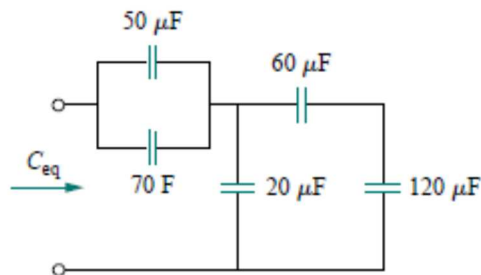


QUESTION FOUR (20MARKS)

- a) Derive an expression of maximum power transfer hence show that $R_{TH}=R_L$. Find the value of R_L for maximum power transfer below circuit in the. (10 marks)



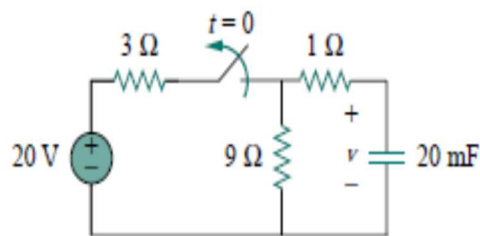
- b) Find the equivalent capacitance seen at the terminal of the given below circuit. (3 marks)



- c) Deduce an expression for free source RC circuits (7 marks)

QUESTION FIVE (20MARKS)

- a) The switch in the circuit given below has been closed for a long time, and it is opened at $t=0$. Find $v(t)$ for $t \geq 0$. Calculate the initial energy stored in the capacitor (8Marks)



- b) Deduce the expression for free source RL circuit hence solve for the below circuit. The switch in the given circuit has been closed for a long time. At $t=0$, the switch is opened. Calculate $i(t)$ for $t > 0$. (12 marks)

