Issue Date: 10^{th} May, 2020 Due by: 17^{th} May, 2020 5:00 PM

ECE113 Basic Electronics
END SEM EXAM 2020

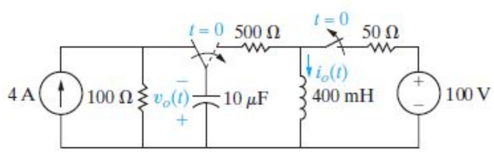
1) All Questions are compulsory.
2) Please use notations appropriately.
3) Maximum Marks:30 (3 marks each)
4) All the students are requested to submit soft copies of their assignments as per the deadline.
5) Please prepare a PDF and upload it over classroom.Mention your Name, Roll no, Section and Group(in the similar manner as you are attending the tutorial) clearly on each sheet of the assignment. Specify sheet number on the top of each sheet.

———-Questions———

1. The circuit shown in Fig. below has been in operation for a long time. At $t = 0$ the two switches move to the new positions shown in the figure. Find

   (a) i_o(t)for t $\geq$ 0,

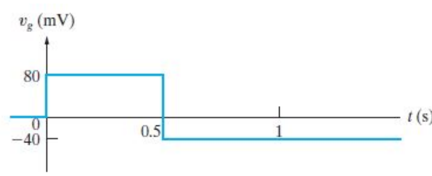
   (b) v_o(t) for t$\geq$ 0.



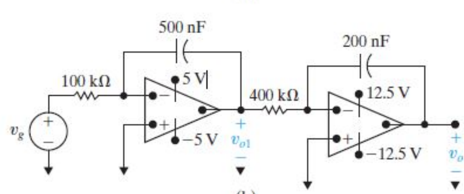
2. The voltage signal of Fig.(a) shown below is applied to the cascaded integrating amplifiers shown in Fig.(b). There is no energy stored in the capacitors at the instant the signal is applied.

   (a) Derive the numerical expressions for v_o(t) and v_{o1}(t) for the time intervals $0 \leq t \leq 0.5s$ and $0.5s \leq t \leq t_{sat}$.

   (b) Compute the value of t_{sat}.

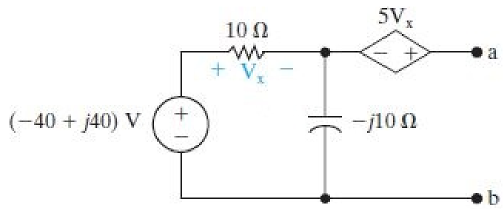


(a)



(b)

3. Find the Norton equivalent with respect to terminals a,b in the circuit of Fig. shown below.



4. You may have the opportunity as an engineering graduate to serve as an expert witness in lawsuits involving either personal injury or property damage. As an example of the type of problem on which you may be asked to give an opinion, consider the following event. At the end of a day of fieldwork, a farmer returns to his farmstead, checks his hog confinement building, and finds to his dismay that the hogs are dead. The problem is traced to a blown fuse that caused a 240 V fan motor to stop.The loss of ventilation led to the suffocation of the livestock.The interrupted fuse is located in the main switch that connects the farmstead to the electrical service. Before the insurance company settles the claim, it wants to know if the electric circuit supplying the farmstead functioned properly. The lawyers for the insurance company are puzzled because the farmer's wife, who was in the house on the day of the accident convalescing from minor surgery, was able to watch TV during the afternoon. Furthermore, when she went to the kitchen to start preparing the evening meal, the electric clock indicated the correct time.The lawyers have hired you to explain (1) why the electric clock in the kitchen and the television set in the living room continued to operate after the fuse in the main switch blew and (2) why the second fuse in the main switch didn't blow after the fan motor stalled.After ascertaining the loads on the three-wire distribution circuit prior to the interruption of fuse A, you are able to construct the circuit model shown in Fig. shown below . The impedances of the line conductors and the neutral conductor are assumed negligible.Both TV and clock are represented by a combined resistance of 12 ohms and 15 A fuse.

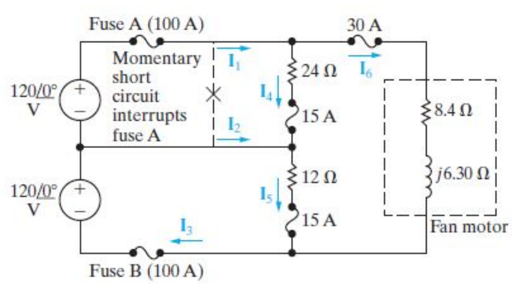
   (a) Calculate the branch currents I_1,I_2,I_3,I_4,I_5 and I_6 prior to the interruption of fuse A.

   (b) Calculate the branch currents after the interruption of fuse A. Assume the stalled fan motor behaves as a short circuit.

   (c) Explain why the clock and television set were not affected by the momentary short circuit that interrupted fuse A.

   (d) Assume the fan motor is equipped with a thermal cutout designed to interrupt the motor circuit if the motor current becomes excessive. Would you expect the thermal cutout to operate? Explain.

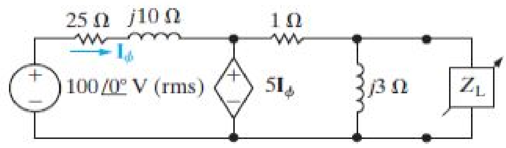
   (e) Explain why fuse B is not interrupted when the fan motor stalls.



5. The load impedance Z_L for the circuit shown in Fig. below is adjusted until maximum average power is delivered to Z_L.

   (a) Find the maximum average power delivered to Z_L.

   (b) What percentage of the total power developed in the circuit is delivered to Z_L ?

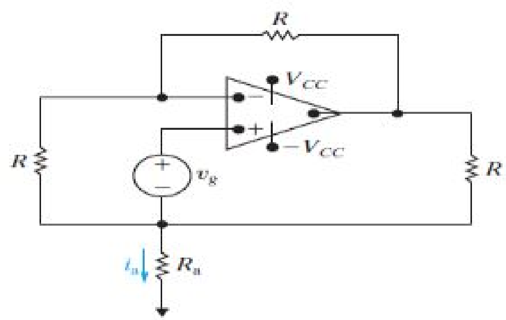


6. (a) Show that when the ideal op amp in Fig. shown below is operating in its linear region

$$i_a = 3v_g/R \tag{1}$$

   (b) Show that the ideal op amp will saturate when

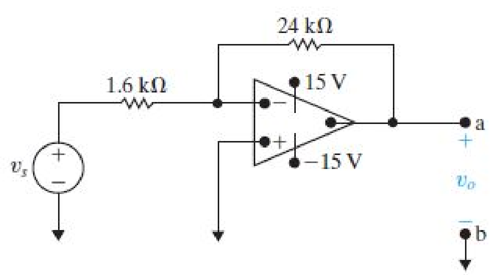
$$R_a = R(\pm V_{cc} - 2v_g)/3v_g \tag{2}$$



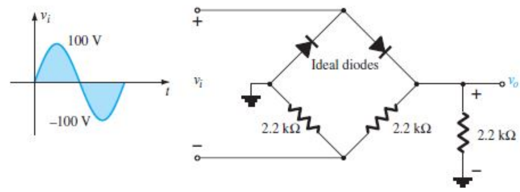
7. (a) Find the Thévenin equivalent circuit with respect to the output terminals a, b for the inverting amplifier of Fig. shown below. The dc signal source has a value of 880 mV. The op amp has an input resistance of 500K Ω, an output resistance of 2k Ω and an open-loop gain of 100,000.

   (b) What is the output resistance of the inverting amplifier?

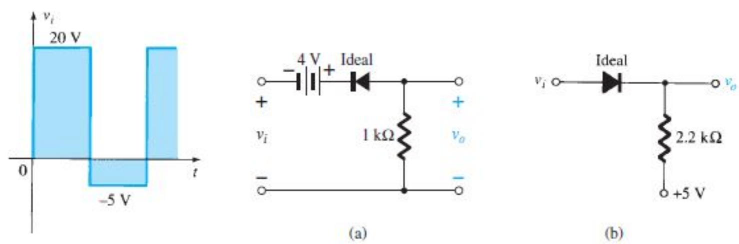
   (c) What is the resistance (in ohms) seen by the signal source vs when the load at the terminals a, b is 300 Ω ?



8. Sketch v_o for the network of Fig.shown below and determine the dc voltage available.



9. Determine v_o for each network of Fig. shown below for the input shown



10. (a) Determine V_L, I_L , I_Z , and I_R for the network of Fig. below if R_L =180 .
    (b) Repeat part (a) if R_L=470 .
    (c) Determine the value of R_L that will establish maximum power conditions for the Zener diode.
    (d) Determine the minimum value of R_L to ensure that the Zener diode is in the "on" state.