EEL101 Major Exam

Semester II, 2008-09 Mar 20, 2009

Electrical Engineering, IIT Delhi

Answer all questions in sequence. Each answer should begin in a new page.

Maximum time: 2 hours

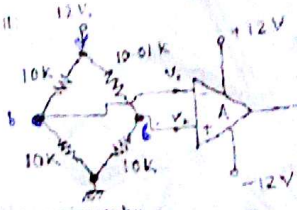
Maximum points: 35

Name, ID, and Group No.:

1. An op-amp has a CMRR 1000. In one case, the op amp is used to achieve a differential amplification where the inputs are $v_1 = +50\mu V$ and $v_2 = -50\mu V$. In another case the inputs are $v_1 = +1050\mu V$ and $v_2 = +950\mu V$. The difference in output voltage in the two cases would be: [2]

   a. 0
   b. 0.1%
   c. 1.0%
   d. 10%
   e. Cannot be calculated because of insufficient parameters

2. Consider the following op-amp circuit [2]

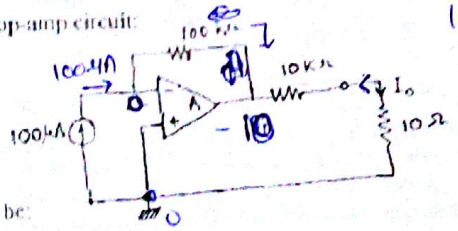


   Given, $A = 1000$

   The output of the circuit V_o will be approximately:

   a. +12 V
   b. −12 V
   c. +3 V
   d. −3 V
   e. 0 V

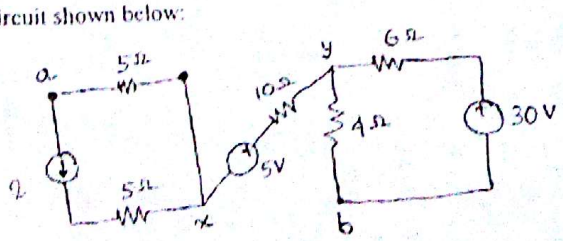
3. Consider the following op-amp circuit: [2]



   The output current I_o will be:

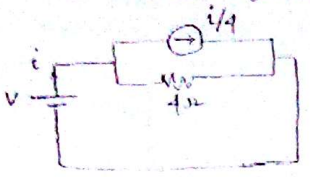
   a. Nearly zero
   b. 1 mA
   c. −1 mA
   d. 10 μA
   e. −10 μA

4. Find V_{ab} in the circuit shown below: [2]



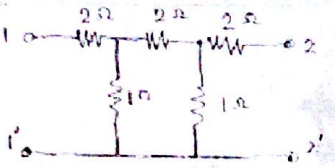
turn over

5. Find the effective resistance faced by the voltage source in the figure shown below. [2]

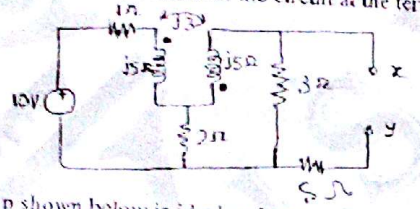


6. A dc source supplies current to a series combination of 1kΩ and 3kΩ resistors. A voltmeter is used to measure the voltage across the 1kΩ resistor. Determine the lowest resistance which the voltmeter must have so that the measurement error does not exceed 1%. [4]

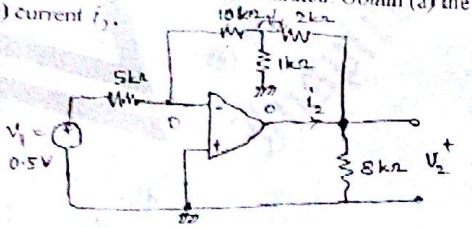
7. Consider the circuit shown below. Is it a symmetrical? Calculate the y-parameters of the circuit, and draw the equivalent Π circuit. [1,2,1]



8. Find the Thevenin's equivalent of the circuit at the terminal xy. [2,2]



9. The op-amp shown below is ideal and not saturated. Obtain (a) the voltage gain, (b) input resistance, and (c) current i_2. [2,2,2]



10. (i) What are the modes of field excitation of a DC machine, and under which circumstance do you think one needs a separately excited DC machine? (ii) A 25kW 125V separately excited dc machine is operated at a constant speed of 3000 rpm with a constant field current such that the open-circuit armature voltage is 125V. The armature resistance is 0.02Ω. The terminal voltage of the machine is 128V. (a) Is the machine working as a motor or a generator? (b) Compute the armature current, terminal power, electromagnetic power (in the air gap field), and mechanical torque generated. [2,1,1,1,1,1]