BITS, PILANI – DUBAI, ACADEMIC CITY, DUBAI
FIRST SEMESTER 2010 – 2011
ES C241 ELECTRICAL SCIENCES – I
COMPREHENSIVE EXAMINATION (CLOSED BOOK)

MAXIMUM MARKS: 120 WEIGHTAGE: 40%
DATE: 23 /12/10 DURATION: 3 HOURS

Write PART A & B & C in separate answer sheets
Answer all questions
PART A

1. For the circuit shown in Figure 1 determine the value of resistance R and the currents i1 and i2 when the total current taken by the circuit is 6A. **[10 marks]**

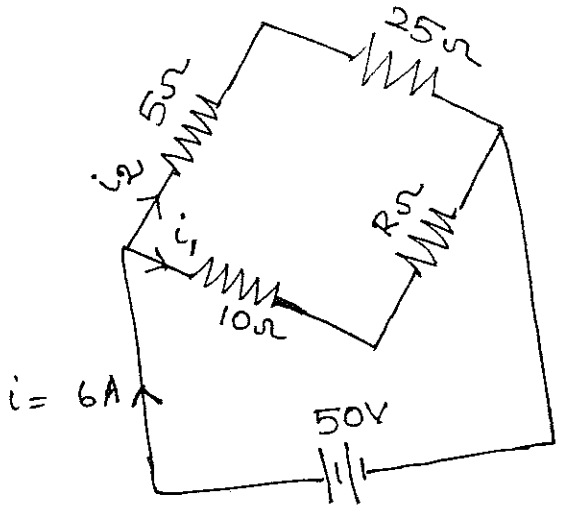

Figure 1

2. Find the node voltages for the circuit shown in Figure 2. **[10 marks]**

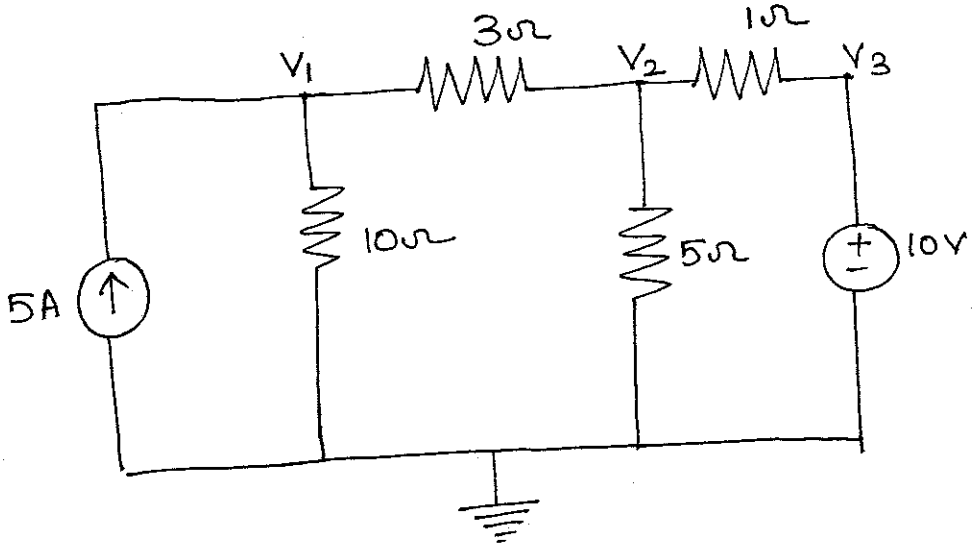

Figure 2

(P.T.O)

3. For the circuit shown in Figure 3, a) Find the Thevenin equivalent of the resulting circuit to the left of terminals a and b. b) Use the Thevenins equivalent circuit to find the power absorbed by the load resistance, R_L = 3Ω. c) Determine the value of R_L which absorbs the maximum amount of power and find this power. **[20 Marks]**

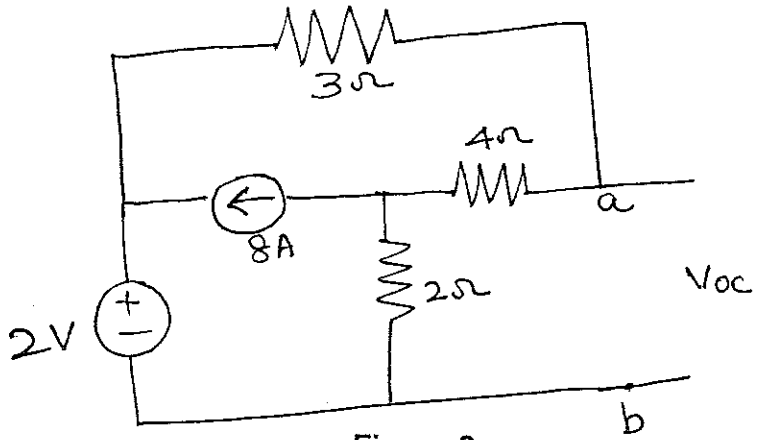

Figure 3

PART B

4. For the circuit shown in Figure 4 find V_L and i_L at time t<0, t>0, t= 0.1 m sec. **[10 marks]**

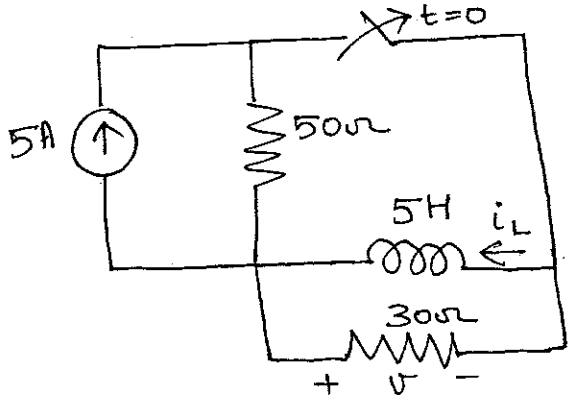

Figure 4

5. Given a series RLC circuit RL = 5 Ω, L = 0.5 H and C = 0.125 F, i(0) = 1A and $V_C(0)$ = 2V. Find the expression and sketch the function for i(t) **[20 marks]**

6. For the circuit shown in Figure 5, derive the output voltage V_o in terms of input voltages. **[10 Marks]**

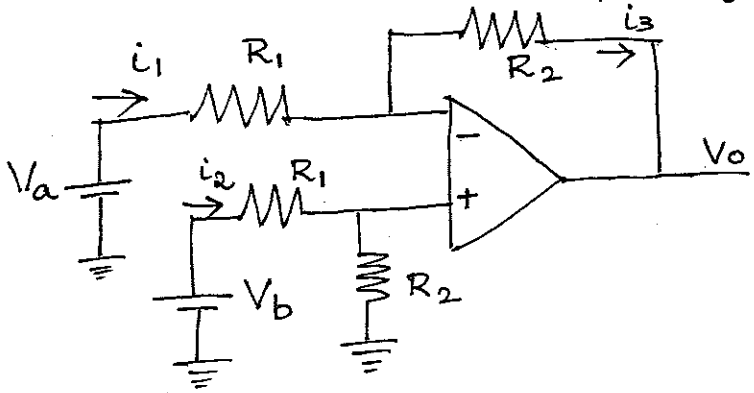

Figure 5

PART C

7. For the circuit shown in Figure 6 assume that the transistor is in the active region and that $\alpha = 1$

   a) find V_{EE} such that i_E=5.3 mA
   b) Given that i_E=5.3 mA, find V_{cc} such that V_{CB}= -3.7V.
   c) Given that i_E=5.3 mA, find the minimum value of V_{cc} such that the transistor is in the active region. **[15 Marks]**

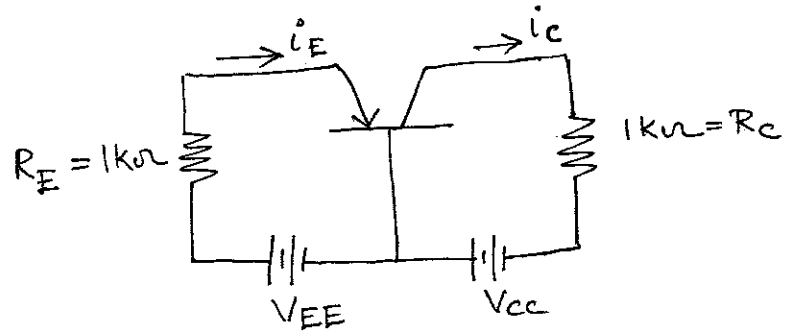

Figure 6

8. The input voltage to the ideal diode circuit shown in Figure 7 is V_s=12sinwt V. Determine the output voltage V_0 and Sketch this function. **[15 Marks]**

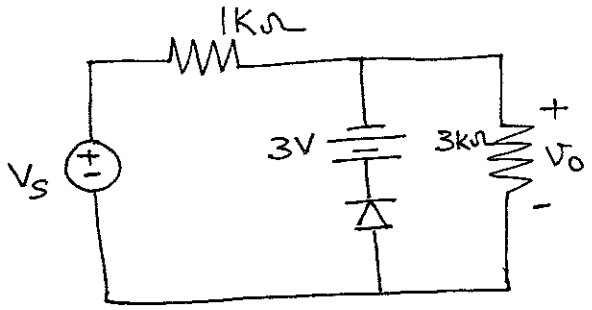

Figure 7

9. For the circuit shown in Figure 8 Suppose that R_D=250 Ω and the Enhancement MOSFET has parameters k=0.25mA/V^2 and V_t=2V find VGG such that i_D= 4 mA and confirm its operation in the active region. **[10Marks]**

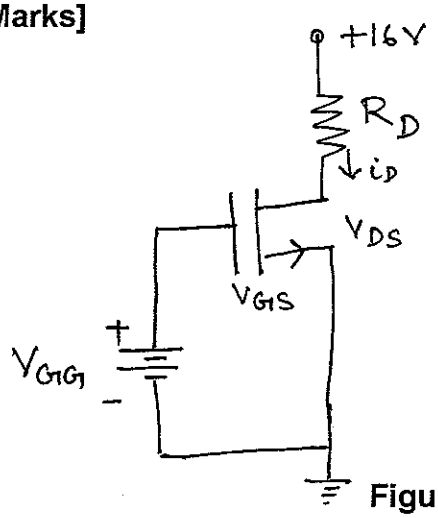

Figure 8

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TEST 2(OPEN BOOK)

MAXIMUM MARKS: 60 **WEIGHTAGE: 20%**

DATE: 11/11/10 **DURATION: 50 MINUTES**

1. In the circuit of the following Figure 1, C=14.28 mF, R= 45 Ω and L= 5 H. the capacitor is charged to 50 V. The switch is closed at t=0 seconds. List all conditions on voltages across the capacitor and current in the inductor at t < 0 sec and at t > 0 sec. Obtain the general solution for the current i (t) and what is the current in the circuit at t=0.5 seconds. **[20 marks]**

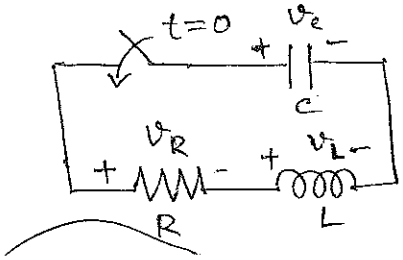

Figure 1

2. For the Op-amp circuit shown in Figure 2 write KCL equations at nodes V & V1 to find a) V_0 and the resistance V_s/i_s. **[20 marks]**

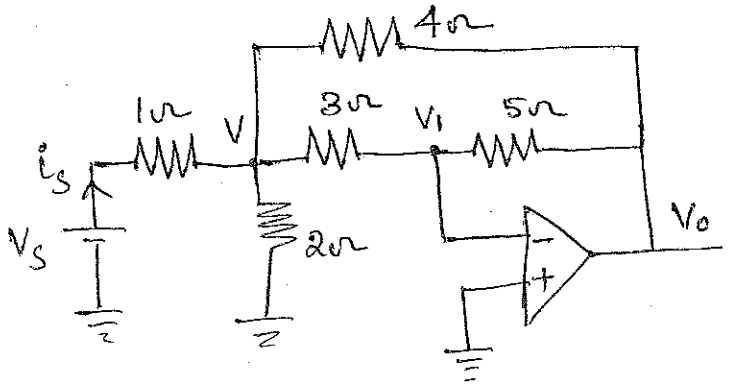

Figure 2

3. For the circuit shown in Figure3, the switch opens at t= 0 sec. Find V_1 (t), V_2(t), i_1(t) and i_2(t) for all values of t. **[20 marks]**

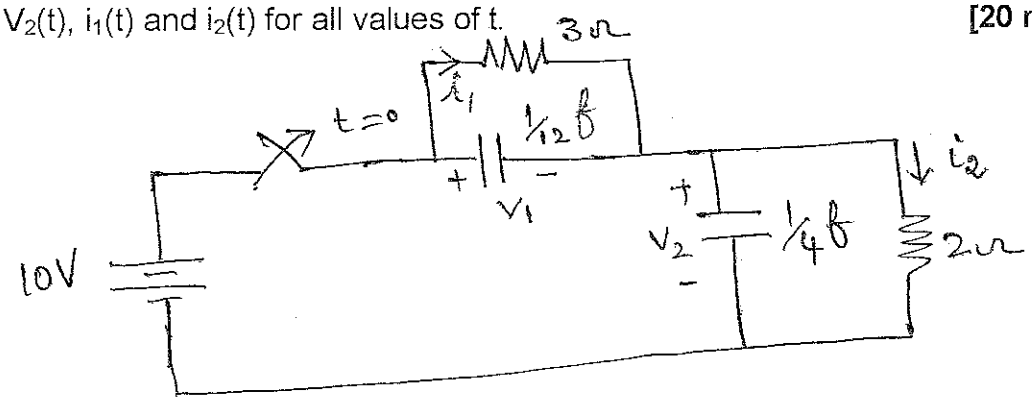

Figure 3

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ES C241 ELECTRICAL SCIENCES – I
TEST 1(CLOSED BOOK)

MAXIMUM MARKS: 75 **WEIGHTAGE: 25%**
DATE: 03/10/10 **DURATION: 50 MINUTES**

1. Consider the circuit shown in Figure1 using nodal analysis find the voltages V1, V2, V3 and V4. **[25 marks]**

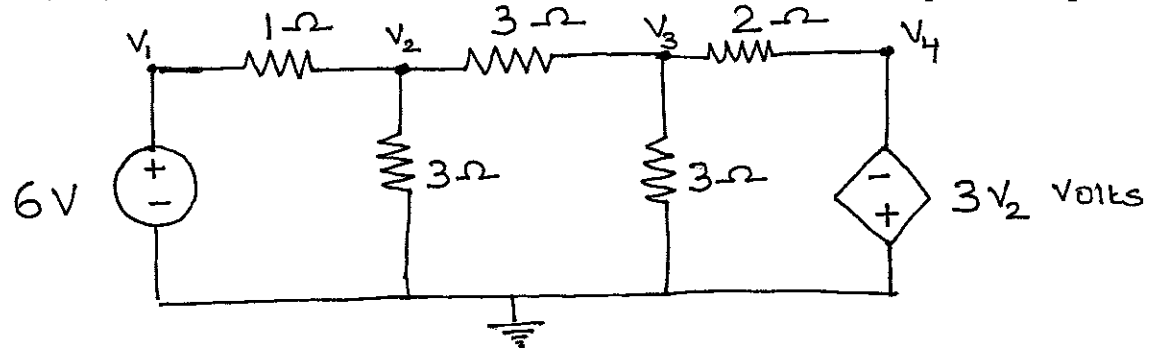

Figure 1

2. For the circuit shown in Figure 2, using Thevenin's theorem find the load current I_L in the 10 Ω resistance. **[25 marks]**

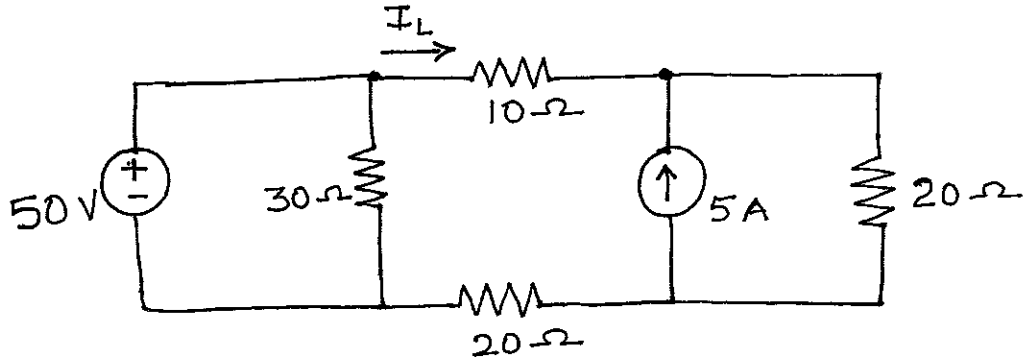

Figure 2

3. For the circuit shown in Figure3, using mesh analysis, find the currents i1, i2 and i3. **[25 marks]**

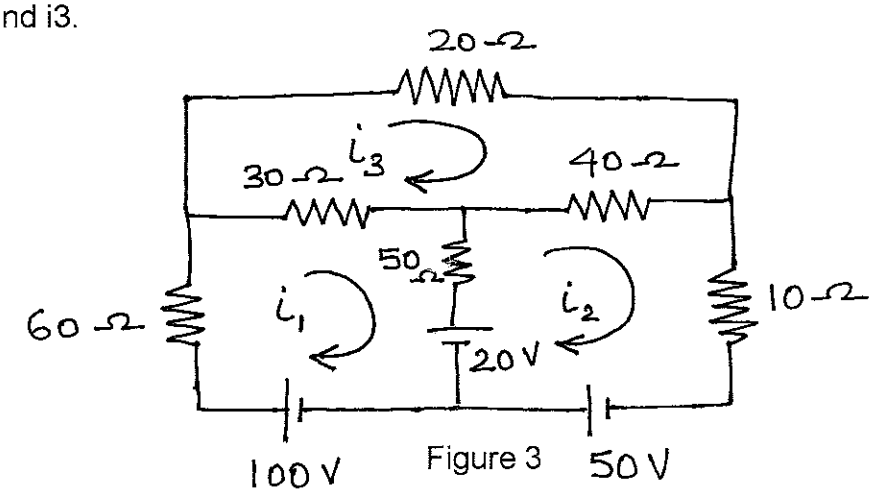

Figure 3

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ES C 241 ELECTRICAL SCIENCES – I
QUIZ 2 (CLOSED BOOK)

MAXIMUM MARKS: 21 **SET 1** **WEIGHTAGE: 7 %**
DATE: 07.12.10 **DURATION: 20 MINUTES**

NAME: **Id. No.:**

1. Draw the V- I characteristic of an ideal diode. [2 M]

2. Write the unit for the following
   (a) J current density _____
   (b) μ mobility of electrons _____
   (c) Є electric field strength _____
   (d) σ, conductivity of metals _____ [4 M]

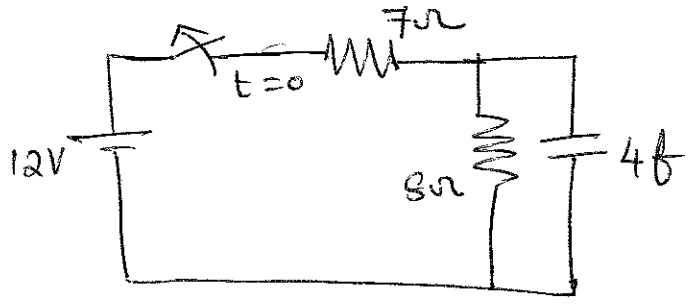
3. The main use of a Zener diode is in
   (a) Motor Speed Control
   (b) Digital Electronics
   (c) Voltage Regulation
   (d) None of the above [1 M]

4. The intersection of diode characteristic and load line is termed as
   _____ [1 M]

5. What separates the two terminals inside a capacitor?
   (a) Metal
   (b) Non Conductive material
   (c)Water
   (d) Non of the above [1 M]

6. Which of these elements forms a p-type semiconductor when doped with Si?
   (a) Antimony
   (b) Boron
   (c) Arsenic
   (d) Mercury [1 M]

7. If V (t) = 12 V, what will the voltage across capacitor for t > 0 seconds [3 M]



8. The time constant τ in RL and RC circuits are given by _____ and _____ respectively [2 M]

9. Find the saturation current of the silicon diode at 360K given that the reverse saturation current at 300K is 50 nA. [2 M]

10. At 0K, pure semiconductors behave as
   (a) Insulators
   (b) Metals
   (c) Conductors
   (d) None of these [1 M]

11. The current voltage relationship equation for a non ideal diode is given by_____ [1 M]

12. For the series RL circuit, the step responses $i_L(t)$ is _____ and $v_L(t)$ is_____ [2 M]

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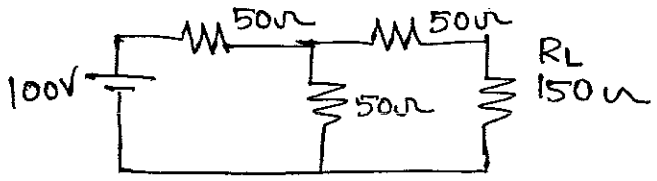
QUIZ 1 (CLOSED BOOK)

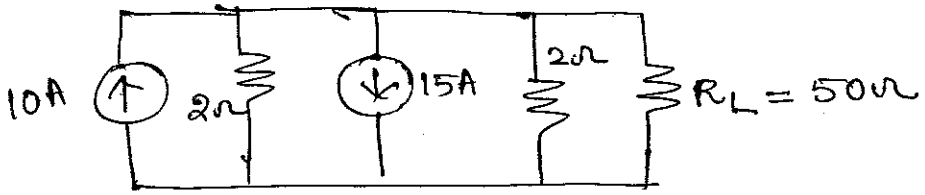
MAXIMUM MARKS: 24 | **SET 1** | **WEIGHTAGE: 8 %**
DATE: 26.10.10 | **DURATION: 25 MINUTES**

NAME:	**Id. No.:**

1. Refer to the following figure, thevenin's equivalent resistance is _____. The value of R_L that absorbs maximum power is _____Pmax=_____ [1+1+1M]



2. For the circuit shown below find out Norton equivalent resistance R_N _____ and the Current Source value _____ [2M]



3. An ideal voltage source is described by a function v(t) = 5 Sin(∏/2)t. The value of this voltage source when t= 1 sec is _____V

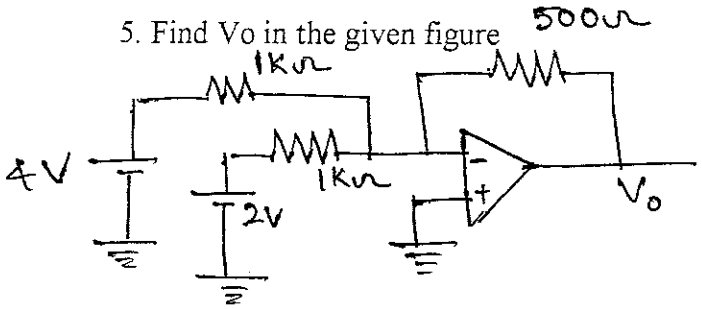
[2M]

4. Identify the incorrect statements with respect to the Thevenin theorem [2M]

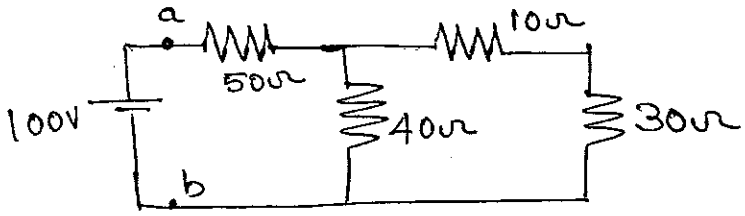
I. Remove the load to find open circuit voltage
II. Short circuit the load to find the open circuit voltage
III. Open circuit all voltage sources to find Thevenin's equivalent resistance R_0
IV. Short all the voltage sources to find Thevenin's equivalent resistance R_0

A. III , IV
B. II, III
C. I,II
D. All are incorrect

5. Find Vo in the given figure [2 M]



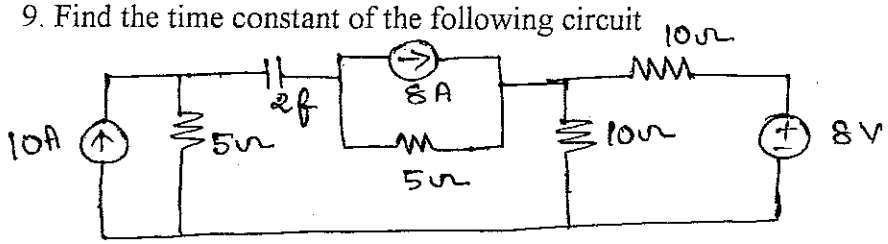
6. The resistance seen at terminal a and b [2M]



7. A closed switch has a resistance of [1M]
   (a) Zero
   (b) infinite
   (c) above 10 Ω
   (d) at least 1 kΩ

8. Calculate the energy absorbed by a load when it draws 10 mA current at a voltage of 2 V for 30 minutes _____ [2M]

9. Find the time constant of the following circuit [4M]



10. Find i(t) for all values of t [4M]