BITS, PILANI – DUBAI CAMPUS, KNOWLEDGE VILLAGE, DUBAI
FIRST SEMESTER 2005 – 2006
ES UC 241 ELECTRICAL SCIENCES – I
COMPREHENSIVE EXAMINATION
(MAKEUP)

MAXIMUM MARKS: 80 **WEIGHTAGE: 40%**
DATE: 18.01.06 **DURATION: 3 HOURS**

1. For the twin – T network shown in Figure 1, Suppose that $R_2 = 3/4\ \Omega$ and $v_2 = 3$ v. Determine R_1 and the resistance $R_{eq} = Vs/i$ loading the battery. [8 marks]

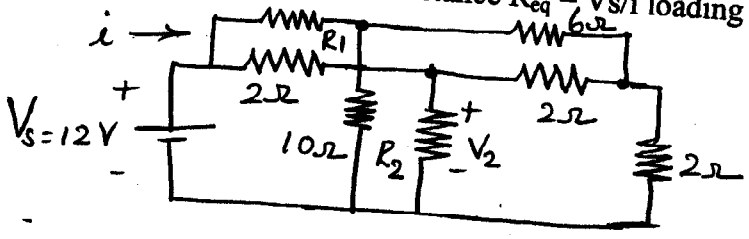

Figure 1

2. Obtain the Norton equivalent for the circuit of Figure 2 to the left of terminals ab. [8 marks]

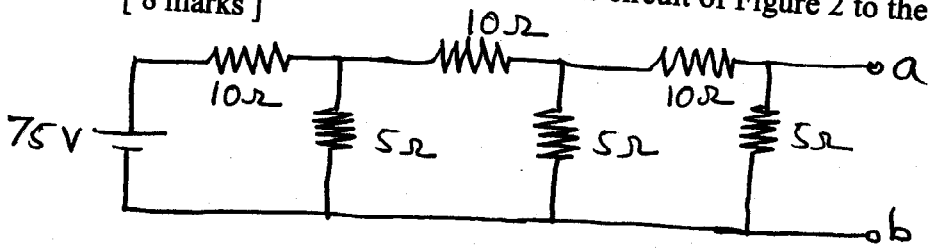

Figure 2

3. Use superposition to evaluate V_X in the figure 3. [8 marks]

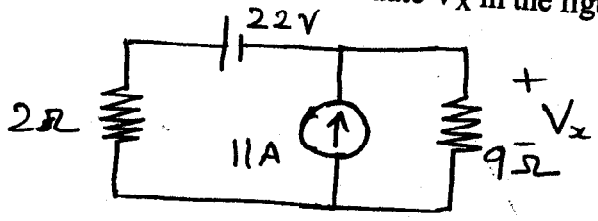

Figure 3

4. In the circuit of Figure 4, the switch is closed at t=0. Find the expression for i(t) for t>0. [8 marks]

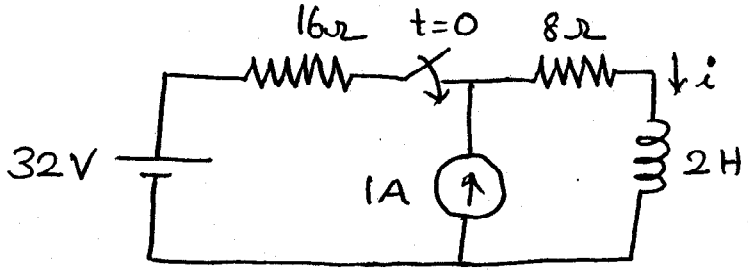

Figure 4

5. For the op-amp circuit shown in Figure 5 find a) V_o b) the resistance V_s/i_s [8 marks].

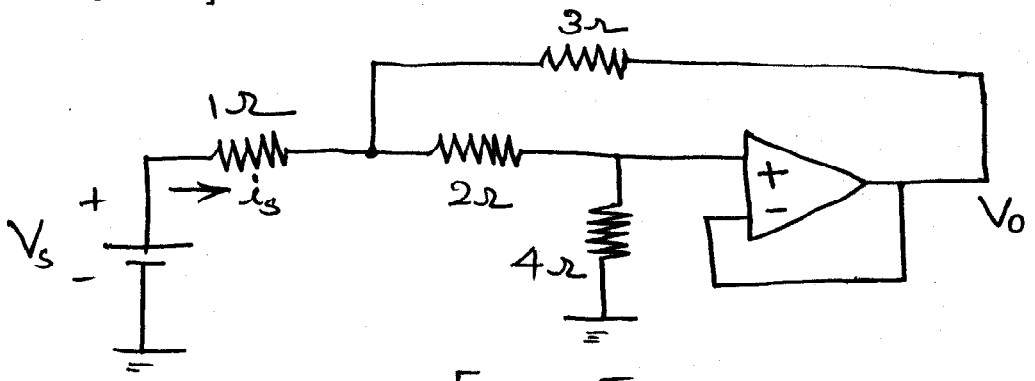

Figure 5

6. For the clipper circuit given in Figure 6 find V_o given that $V_s=6\sin\omega t$ V and the diode is ideal. [8 marks]

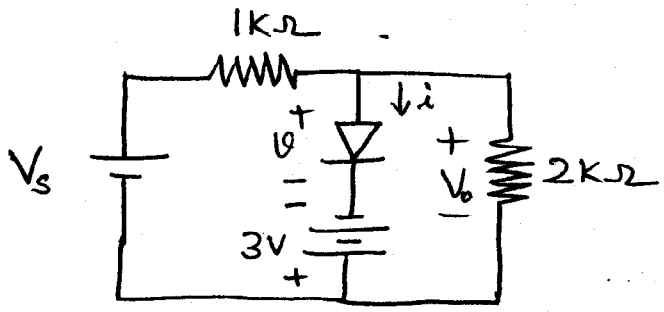

Figure6

7. For the circuit shown in Figure 7, suppose that R_B=180k Ω, R_C= R_E= 1kΩ, V_{BB}=0v, V_{CC}=V_{EE}=5V. Given that the BJT has β=100, Verify that the transistor is in the active region by finding a) i_B b)i_c and c)V_{CE}. [8 marks]

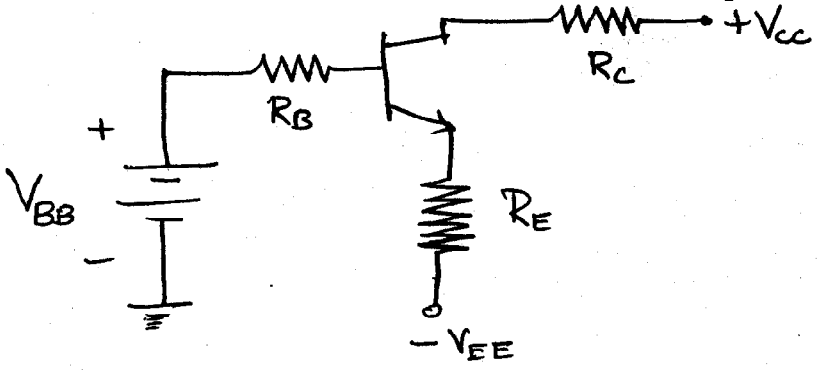

Figure 7

8. For the circuit given in figure 8, suppose that the MOSFET has parameters I_{DSS}=8mA and V_P= - 2V. Find V_{GS}, i_D and V_{Ds}. [8 marks]

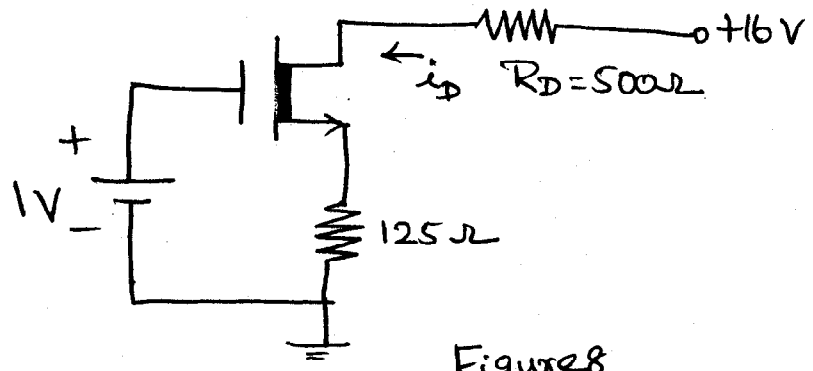

Figure8

9. (i)Write a Pspice input file for the circuit given in Figure 9 to get an output file for listing the node voltage. [5 marks]
(ii) Mention any six benefits of negative feedback. [3 marks]

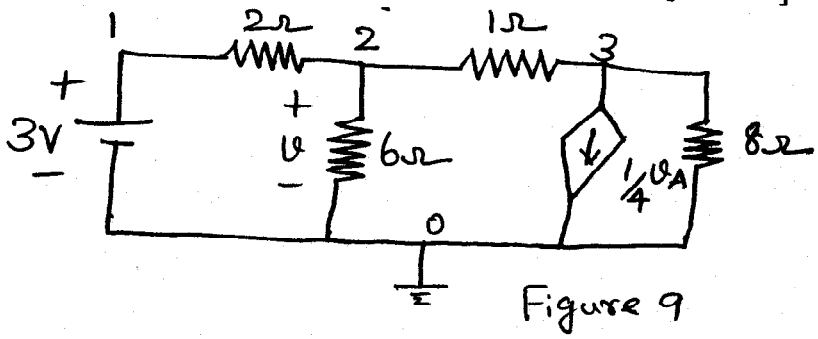

Figure 9

10. Suppose a three variable truth table has a low output for the first three input conditions: 000,001 and 010. If all other outputs are high,
   a) Draw the truth table and write the expression in product of Sums (POS) form. [4 marks]
   b) Assuming that the variable and their complements are available, implement the POS expression with a two-level NOR circuit. [4 marks]

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COMPREHENSIVE EXAMINATION

MAXIMUM MARKS: 80 **WEIGHTAGE: 40%**
DATE: 28.12.05 **DURATION: 3 HOURS**

Answer All Questions **Part A**

1. Refer Figure1 a) Find $R_{eq} = v_1/i_1$ b) Find the voltage v_2 in terms of applied voltage v_1. [4+4 Marks]

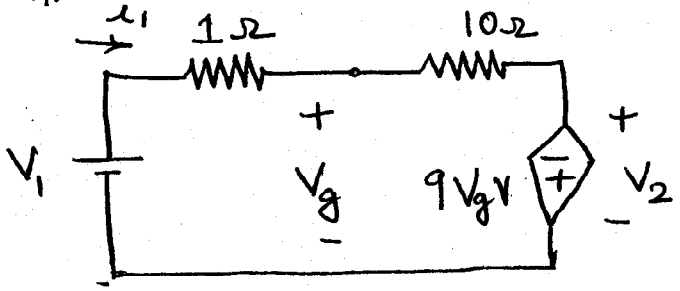

Figure 1

2. Use mesh analysis to find the resistance R=v/i for the circuit given in Figure 2. [8 Marks]

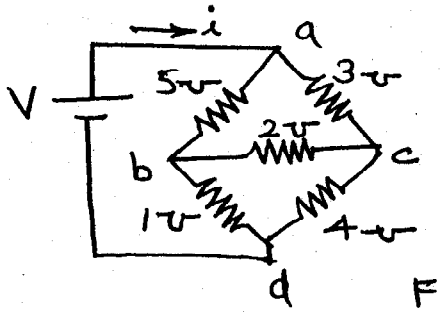

Figure2

3. For the circuit of figure 3, find the thevenin equivalent as viewed by the resistance R. Find the value of R for maximum power dissipation in it and the value of this power. [8 Marks]

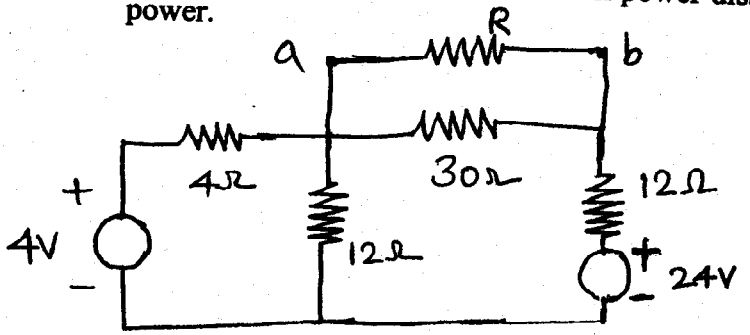

Figure 3

4. After having been closed for a long time, the switch in the circuit of figure 4 is opened at t=0. Find $i_L(t)$ for all t [8 Marks]

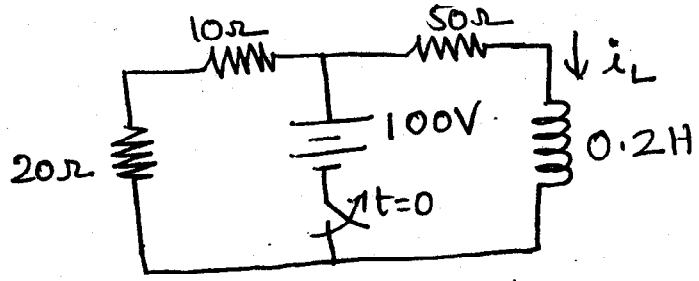

Figure 4

5. Calculate the ouput voltage v_0 in the circuit of the figure 5. [8 Marks]

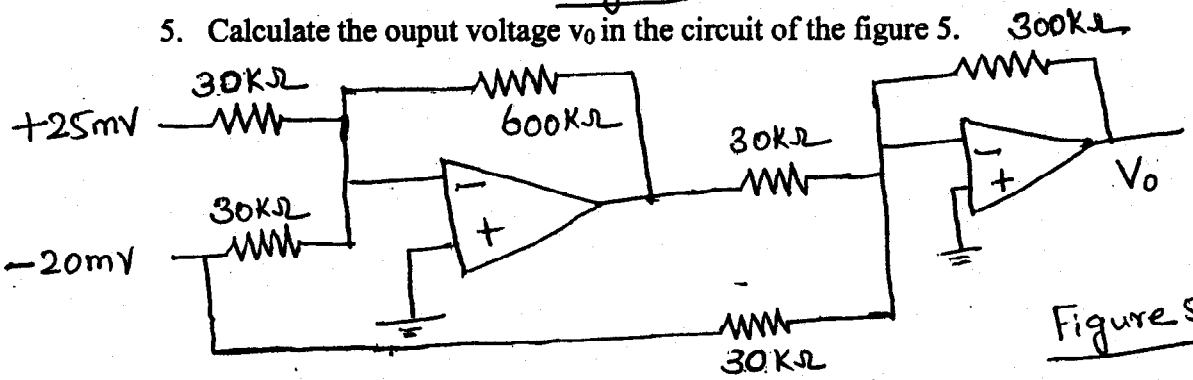

Figure 5

Part B [Write PART B on a separate sheet]

6. For the voltage regulator circuit given in figure 6, suppose that R_L= 1KΩ and Vs=24V. Determine the range of values for R for which the diode will operate in the breakdown state and −50mA<=i<=−5mA. [8 Marks]

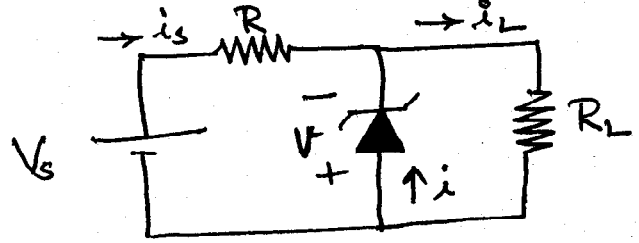

Figure 6

Given : Breakdown voltage of the zener diode is 6V.

7. The BJT in the circuit shown in figure 7 has β = 100; Suppose that R_c=0 Ω, V_{BB}=V_{CC} =0V and V_{EE} = 5V. Find R_B and R_E such that the transistor is biased in the active region at i_c=2mA and V_{CE}=2.7V. [8 Marks]

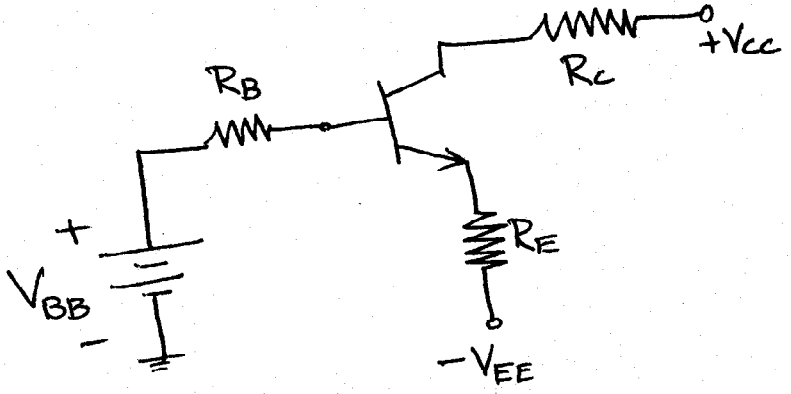

Figure 7

8. a) Bring out the differences in the drain characteristics of depletion MOSFET and enhancement MOSFET for an n- channel device. Draw both the characteristics clearly.

b) For the circuit given in figure 8, suppose that JFET has parameters I_{DSS}=8mAand V_p=−4V. Determine the value of R_D for which the JFET operates on the border between the active and the ohmic regions.

[3 +5 Marks]

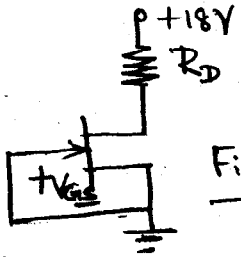

Figure 8

9. Name the various basic ways of connecting the feedback signal and explain with diagrams for each type.

[8 Marks]

10. Given the logic function

i) $Y = \overline{A}\,C\,\overline{(\overline{A}BD)} + \overline{A}\,B\,\overline{C}\,\overline{D} + A\,\overline{B}\,C$

[5+3 Marks]

a) Simplify the expression

b) Assuming complements are available synthesize the simplified expression using the basic gates.

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TEST 2(OPEN BOOK)

MAXIMUM MARKS: 20 **WEIGHTAGE: 20%**
DATE: 13.11.05 **DURATION: 50 MINUTES**

1. In the circuit shown in Figure 1, steady state response has been reached,the switch s is changed to position b at t = 0. Determine v(t) & $i_L(t)$. [5marks]

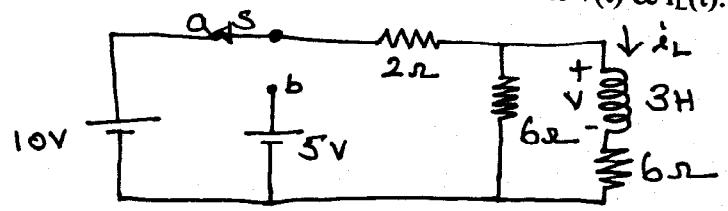

Figure 1

2. Consider the circuit shown in Figure 2. Find i and V using super position theorem. [5marks]

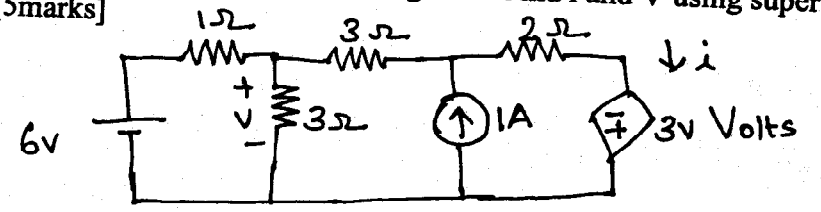

Figure 2

3. In figure 3 the switch s has been in position 'a' for a long time. At t =0 the switch is thrown to position 'b'. Determine i(t) for all t. [5marks]

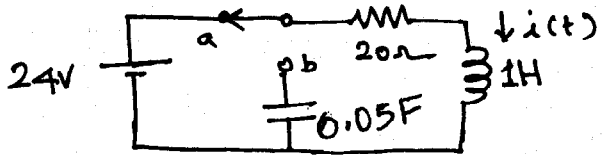

Figure 3

4. A germanium diode has a saturation current of 5 nA at 300K. [5marks]
   a) Find the current for the case that the forward bias voltage is 0.7V.
   b) Find the forward bias voltage that result in a current of 15mA.
   c) Suppose diode is used in the circuit as shown in Figure 4. If V1= 12V, what value of R results in a current of 0.5 A.

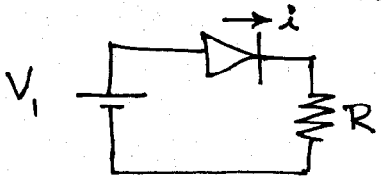

Figure 4

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FIRST SEMESTER 2005 – 2006
ES UC 241 ELECTRICAL SCIENCES – I
TEST 1(CLOSED BOOK)

MAXIMUM MARKS: 20 **WEIGHTAGE: 20%**
DATE: 25.09.05 **DURATION: 50 MINUTES**

1. For the circuit shown in Figure 1, find voltage drop across 5 Ω resistor and value of R. **[2.5 + 2.5 M]**

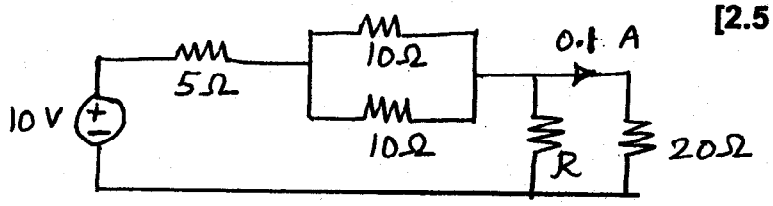

Figure 1

2. With reference to the Figure 2, find the resistance between terminals (i) cd (ii) ac. **[2.5 + 2.5 M]**

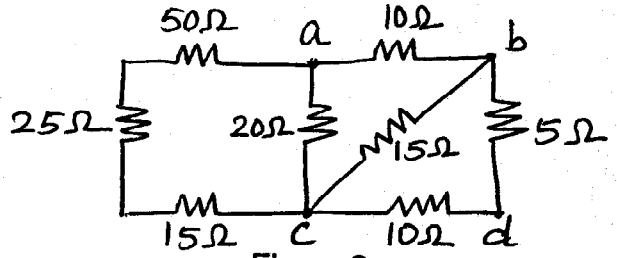

Figure 2

3. Find the thevenin equivalent at terminals a and b for the Figure 3 shown. At what value of load, the maximum power be absorbed and what is the value of maximum power? **[4 + 1M]**

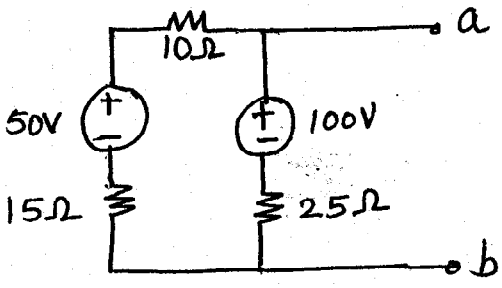

Figure 3

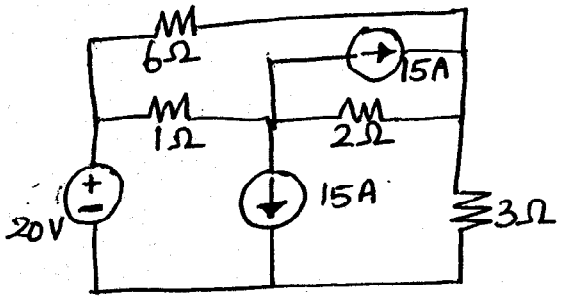

Figure 4

4. For the circuit shown in Figure 4, **[2.5 + 2 + 0.5 M]**
   a) Write the nodal equations at appropriate nodes.
   b) Solve for the nodal voltages.
   c) Find the value of current that flows through 6 Ω resistor.