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Concordia UNIVERSITY

FACULTY OF ENGINEERING AND COMPUTER SCIENCE
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE		NUMBER	SECTION
INDUSTRIAL ELECTRONICS		ELEC 318/2	T
EXAMINATION	**DATE**	**TIME & PLACE Room:**	**# OF PAGES**
MID-TERM	Friday, October 23, 1998	08:45 - 10:00 SH-447	1 + 5 = 6
PROFESSOR		**LAB INSTRUCTOR**	
H. HONG			

MATERIALS ALLOWED ☒ NO ☐ YES (PLEASE SPECIFY)

CALCULATORS ALLOWED ☐ NO ☒ YES

SPECIAL INSTRUCTIONS:

ANSWER ALL FIVE (5) QUESTIONS

RETURN EXAM QUESTIONS WITH YOUR ANSWER BOOKLET

Name: Santos, J.C. I.D.: _____

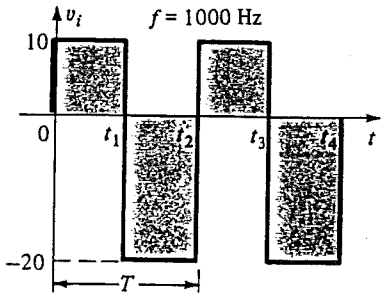
Surname, given names

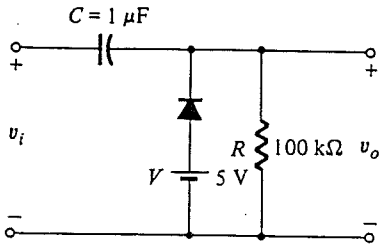
QUESTION #	MARKS per QUESTION	MARKS
1	4	ϕ
2	9	9
3	15	15
4	15	8½
5	7	7
TOTAL	50	39½

+7 = $\frac{46\frac{1}{2}}{50}$ = $\frac{14}{15}$

Question #1 (4 marks)

For the square wave input v_i, sketch the steady-state output voltage v_o.
The diode has a cut-in voltage $V\gamma = 0.7$ V.

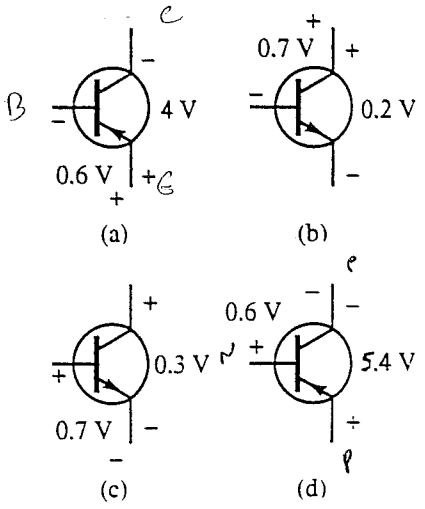




Question #2 (a=1, b=8 →→→→ 9 marks)

For each of the transistors shown in the figure:

a) Identify the type of BJT transistor.
b) Determine the operating state.

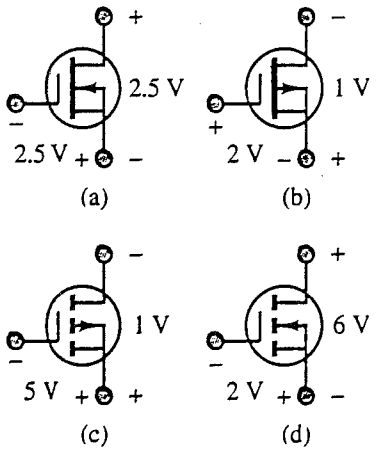


a)

Question #3 (a=2, b=1, c=4, d=8 →→→→ 15 marks)

The transistors shown in the figure have $|V_T| = 3$ V. For each transistor:

a) Identify the type of MOSFET transistor.
b) When the MOSFET is in the active region, indicate the direction of convention current flow.
c) Sketch the drain characteristics of i_D versus v_{DS}. Indicate V_T on the sketch.
d) Determine the operating state of the MOSFET.



Question #4 (a=4, b=1, c=3, d=3, e=4 →→→→ 15 marks)
For the circuit shown:

a) Find the quiescent point of the transistor.
b) Draw the AC equivalent circuit, using h parameters.
c) Find the voltage gain v_L/v_{in} (h_{ie} = 2.6 kΩ, neglect h_{re} and h_{oe}).
d) Find the input resistance r_i (h_{ie} = 2.6 kΩ, neglect h_{re} and h_{oe}).
e) Find the expression for the output resistance r_o as seen by the load (only neglect h_{re}).

Information if required:

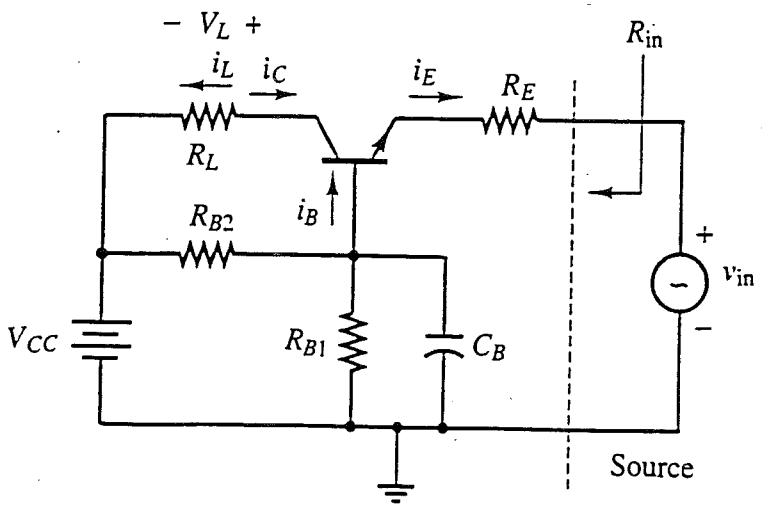
$V_{BE} = f_1(i_B, V_{CE})$
$i_C = f_2(i_B, V_{CE})$

$$h_{ie} = \left.\frac{\partial v_{BE}}{\partial i_B}\right|_{I_{BQ}} \quad (\Omega)$$

$$h_{oe} = \left.\frac{\partial i_C}{\partial v_{CE}}\right|_{V_{CEQ}} \quad (S)$$

$$h_{fe} = \left.\frac{\partial i_C}{\partial i_B}\right|_{I_{BQ}} \quad \left(\frac{A}{A}\right)$$

$$h_{re} = \left.\frac{\partial v_{BE}}{\partial v_{CE}}\right|_{V_{CEQ}} \quad \left(\frac{V}{V}\right)$$



Amplifier

$R_E = 50\ \Omega$ $V_{CC} = 10$ V
$R_L = 100\ \Omega$ $R_{B1} = 513\ \Omega$
$\beta = 75 = h_{fe}$ $R_{B2} = 2730\ \Omega$

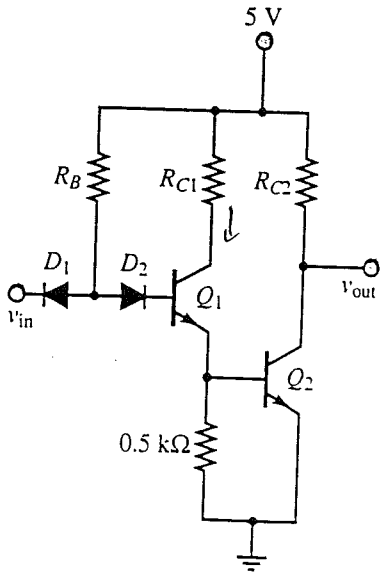
Assume the BJT has V_γ = 0.6V.

Question #5 (a=4, b=2, c=1 →→→→ 7 marks)

For the inverter circuit shown:

$R_B = 4\ k\Omega$
$R_{C1} = 2.5\ k\Omega$
$V_{CE(sat)} = 0.2\ V$
$\beta = 100$ (active region)
$V\gamma = 0.6\ V$

a) Show that transistor Q_1 saturates when v_{in} is high.
b) How much current is flowing into the base of transistor Q_2 ?
b) Determine R_{C2} to ensure that transistor Q_2 also saturates.



CONCORDIA UNIVERSITY - DEPARTMENT OF MECHANICAL ENGINEERING

COURSE:	NUMBER	SECTION:
INDUSTRIAL ELECTRONICS	**ELEC 318**	**X**

EXAMINATION:	DATE:	TIME:	#OF PAGES:
FINAL	**Dec. 16, 1992**	**09:30-12.30**	**6**

INSTRUCTOR:

Ramesh RAJAGOPALAN

MATERIALS ALLOWED:

☐ NO ☒ YES

- **Programmable electronic calculators permitted.**
- **One double sided, 8.5" x 11" sheet of notes.**

SPECIAL INSTRUCTIONS:

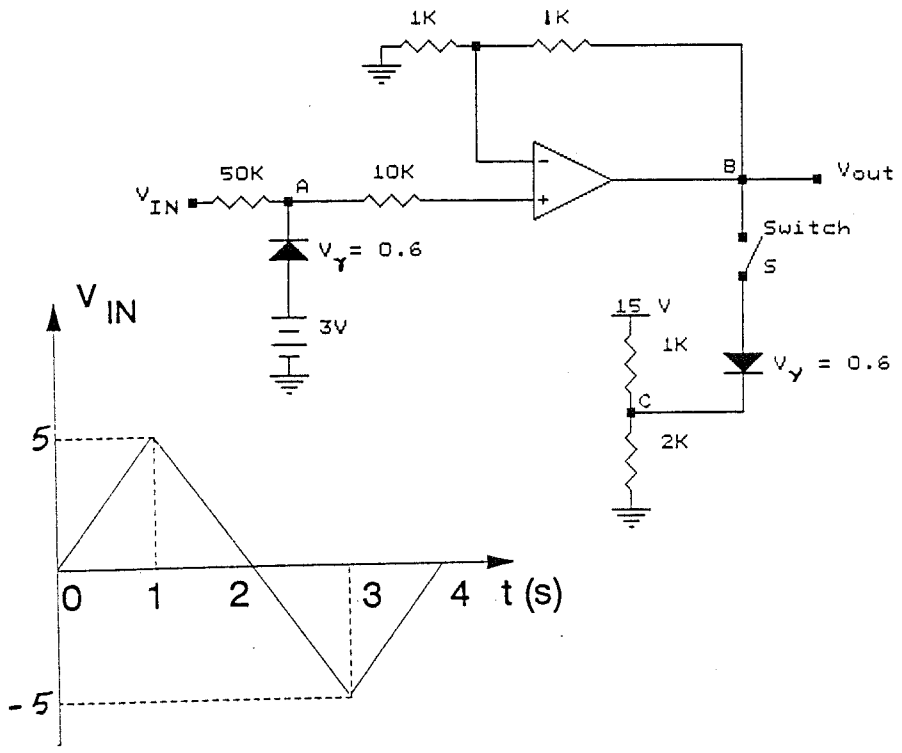
- **Answer 6 questions out of 9.**
- **All questions carry equal marks.**
- **Indicate question number on top right hand side of every page.**
- **Highlight answer.**

Question 1

A 4-bit number is an input to a logic circuit. The number is represented as $A_3A_2A_1A_0$. The output of the logic circuit is 1 if and only if the decimal equivalent of the input number (A) is divisible by 2. Construct a truth table showing all possible combinations. Minimize if necessary using K-Map. Implement the minimum form using minimum number of "2-input" gates. Assume inverse of each signal is available.

Question 2

Draw the output voltage waveform for the given input waveform when the switch S is (1) open and (2) closed. Name each part of the circuit.



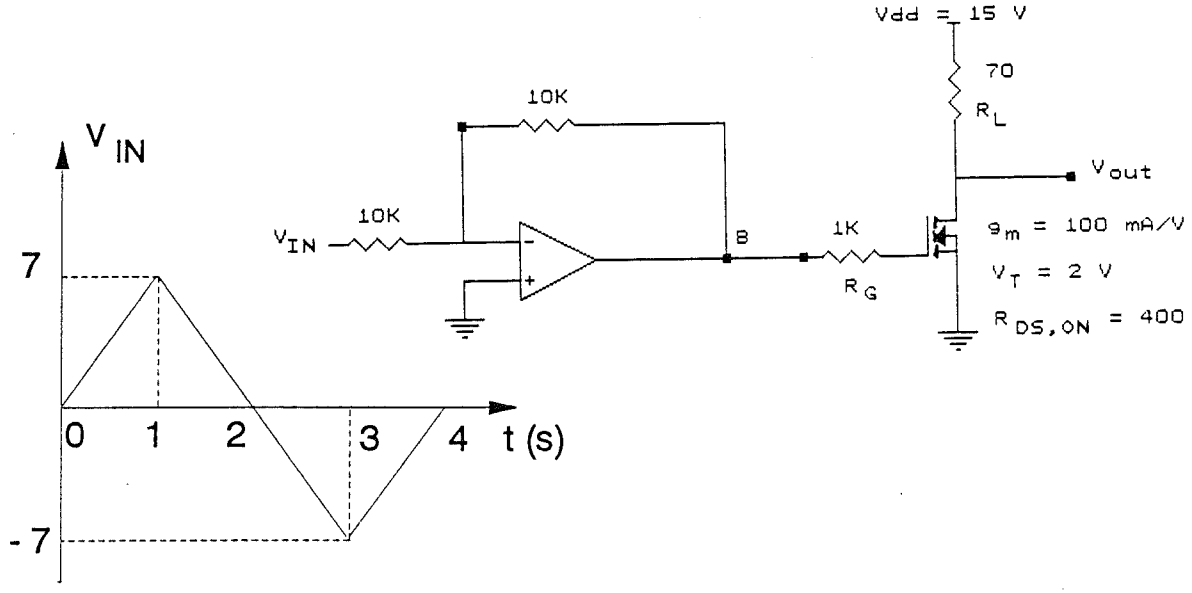
Question 3

Write the Boolean expression for the truth table given below. Implement this truth table using gates. Name the circuit.

S_1	S_0	Output Y
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

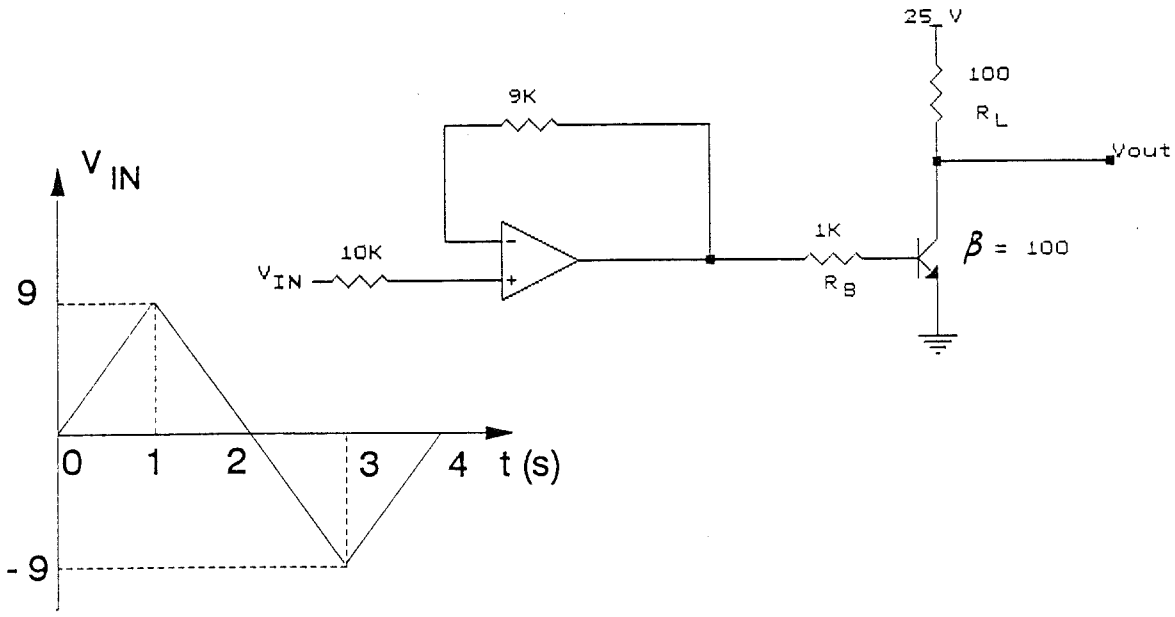
Question 4

For the given input waveform, draw the waveform of the voltage across R_L and V_{out}, and the power dissipated in the transistor. Find the value of R_G required to drive the transistor into saturation.



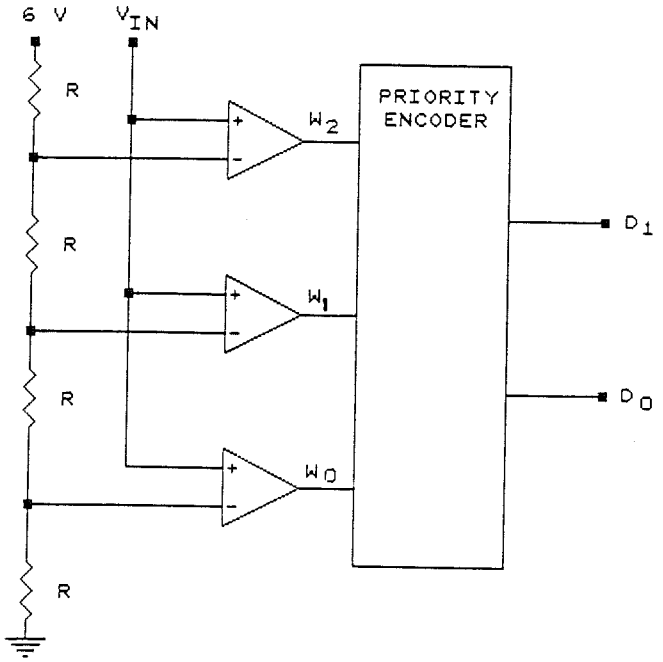
Question 5

Find the mode of operation of the transistor for the given input waveform. Draw the waveform across R_L and compute the power dissipated by the transistor for each time interval. Find the minimum value of i_B that would drive the transistor into saturation. Find the corresponding value of V_{IN}.



Question 8

Identify the function performed by the circuit. Tabulate the voltage levels of W_0, W_1 and W_2, and the outputs of the priority encoder (D_0, D_1), for V_{IN} = 0, 1.6, 3.1 and 5.0 V, assuming that 0 V corresponds to a logic level-0 and saturation level (10 V) to logic level-1. Write the Boolean equation of the priority encoder used in this circuit.



Question 9

Name the circuit given below. Sketch the waveform of Q_0, Q_1, Q_2 and Q_3 for the given input signal.