Arab Academy for Science, Technology & Maritime Transport

College of Engineering and Technology

EXAMINATION PAPER

Department: Computer Engineering **Date**: 30-December 2020

Course Title: Digital Electronics **Time allowed**: **2** Hours

Course Code: CC 341

Lecturer: Prof. Dr. Mohamed T. El-Sonni

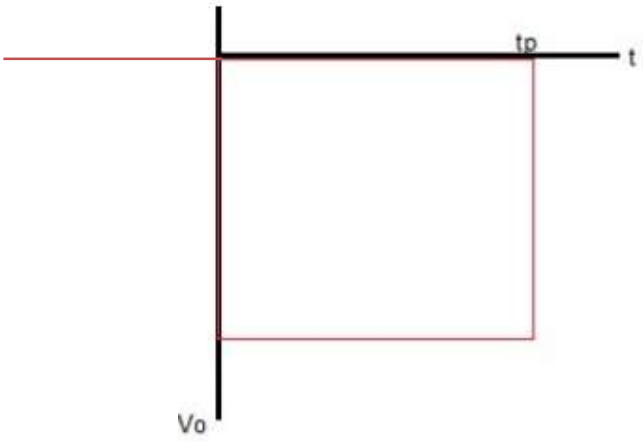
Student's Name : ----------

Student's Department :---------- Reg.# : ----------

Question #	Marks	
	Available	Actual
1	3	
2	3	
3	3	
4	3	
5	2	
6	3	
7	3	
Total	20	
Lecturer	**Name**: Prof. Dr. Mohamed T. El-Sonni	
	Signature:	
	Date: 30 December 2020	

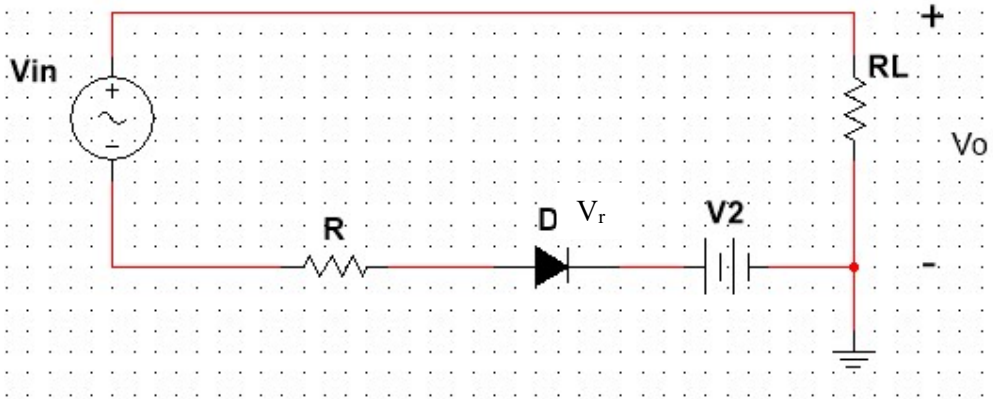
Question 1: **[Linear wave shaping]**

A negative pulse of 6V amplitude is applied to an RC high-pass filter circuit with R = 22KΩ and C = 0.47 µF. Sketch the output waveform and Specify V_o ($0 \leq t < t_p$), $V_o(t_{p+})$, $V_o(t_{p-})$ and V_o ($t > t_p$) when:
t_p = 10.34 msec.

Symbol	Formula / Condition	Calculations / Results	Units
Fall time = t_f			
Vo ($0 \leq t < tp$)			
V1 =Vo(tp-)			
V2 =Vo(tp+)			
Vo ($t > tp$)			
Draw RC high-pass filter circuit			
Draw output waveform			

Question 2: **[Non-linear wave shaping]**

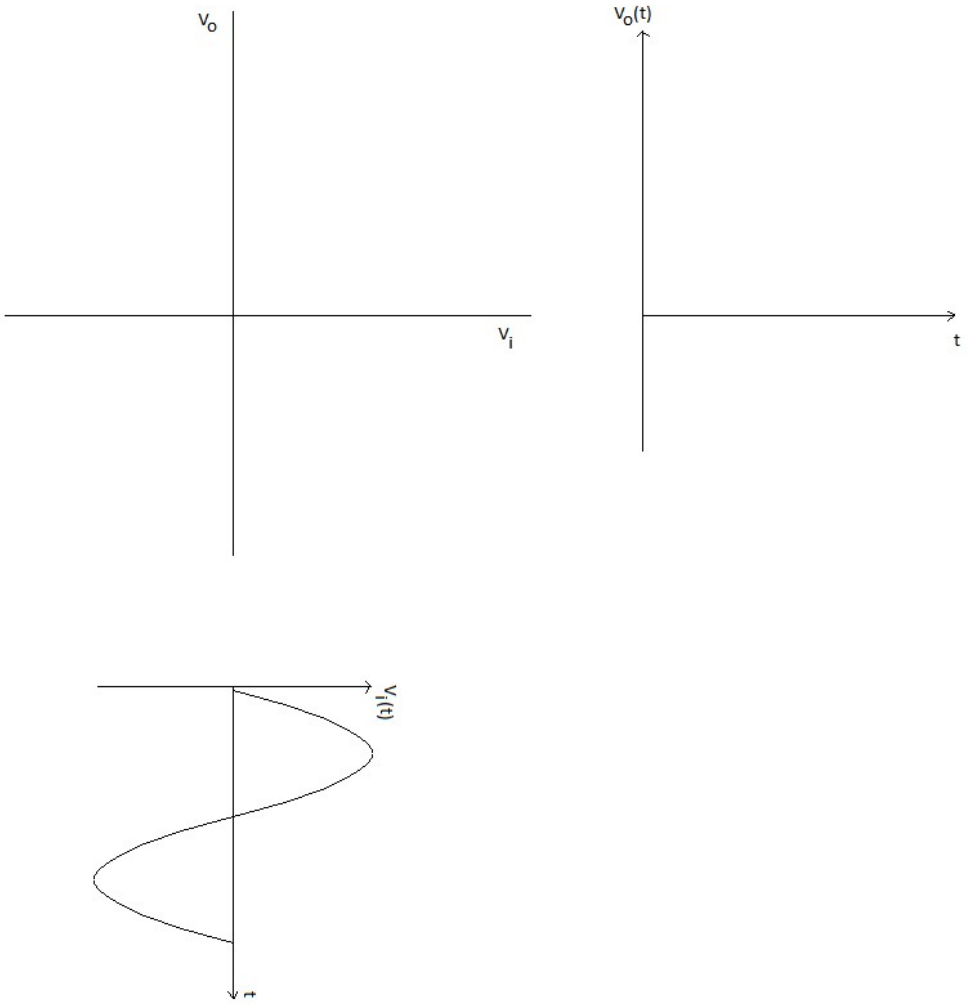
For the following circuits, draw the appropriate transfer characteristic output voltage. Know that $V_{max} > V_r$ and $R_L = 2R$



D is ON:

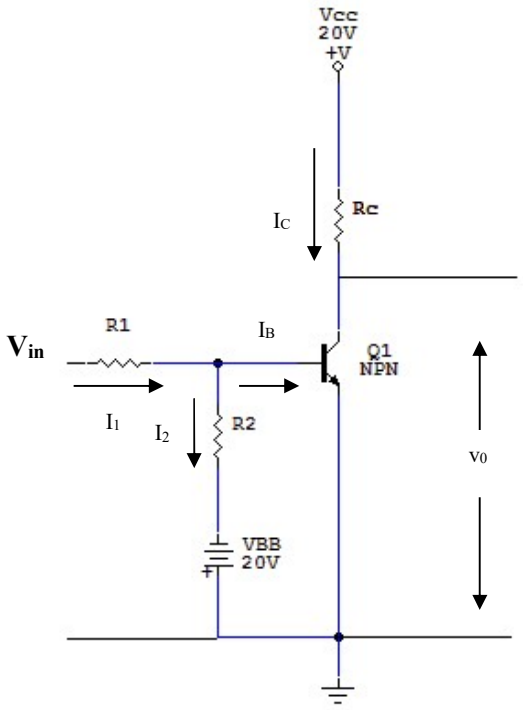
D is OFF:

Break point:



Question 3: **[Switching characteristic of devices]**

Design a Common Emitter transistor switch operating with V_{CC}=20v and V_{BB}=20v. The transistor is expected to operate at $I_{C(sat)}$=5mA, $h_{FE(min)}$=25, $V_{CE(sat)}$=0.2V, $V_{BE(sat)}$=0.7V.



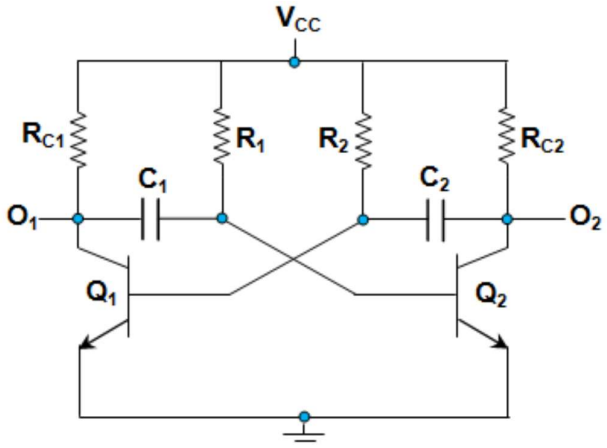
Solution:

Symbol	Formula / Condition	Calculation / Result	Units
R_C =			
$I_{B(min)}$ =			
$I_{B(sat)}$ =			
I_2 =			
R_2 =			
I_1 =			
R_1 =			
V_i (high level) =			

at V_i (low level) =0			
V_B =			
Q is in cut-off?			

Question 4: [Astable multivibrator]

Design an astable multivibrator, assuming that silicon devices with $h_{FE(min)}$ = 45 are used. Also assume that Vcc = 12v, $I_{C\,(sat)}$ = 5 mA. Let the desired frequency of oscillations be 5 KHz and the required duty cycle 70%. For transistor used, $V_{CE\,(sat)}$ = 0.2v, $V_{BE\,(sat)}$ = Vσ = 0.7v.

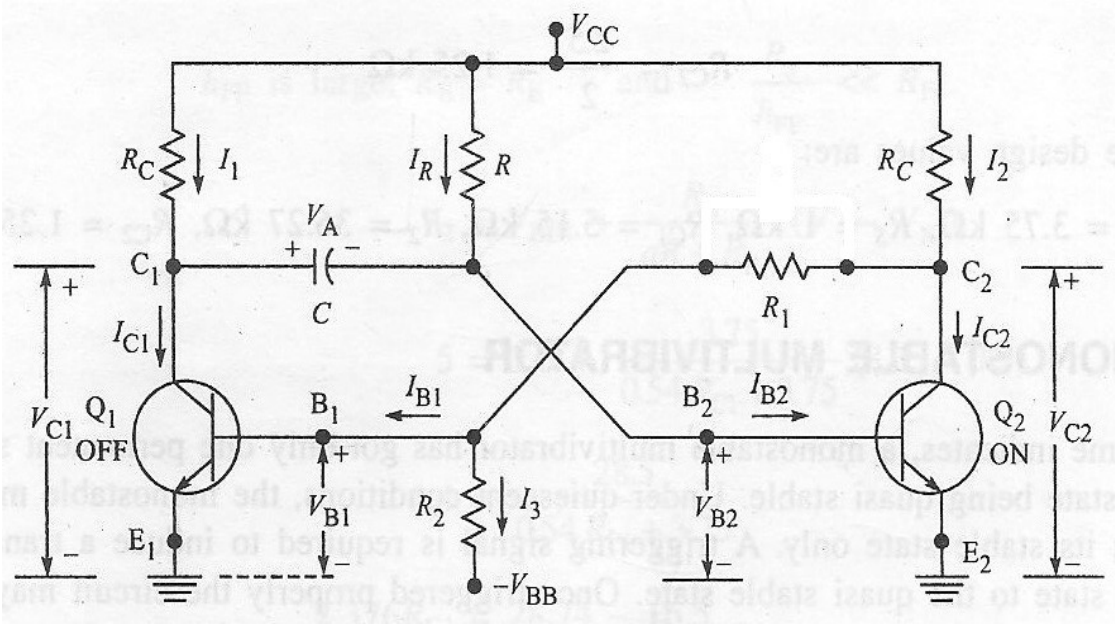


Solution:

Symbol	Formula / Condition	Calculation / Result	Units
R_C			
$I_{B\,(min)}$			
$I_{B\,(sat)}$			
$R_1 = R_2 = R$			
For an unsymmetric a-stable multivibrator (T1 ≠ T2) It is required to fix the component values of R1, R2, C1 and C2 let R1 = R2 = R			
T_1			
T_2			
C_1			
C_2			

Question 5: **[Monostable multivibrator]**

Diagnose the following circuit when a component is short circuited (S.C) and when a component is open circuited (O.C).



Solution:

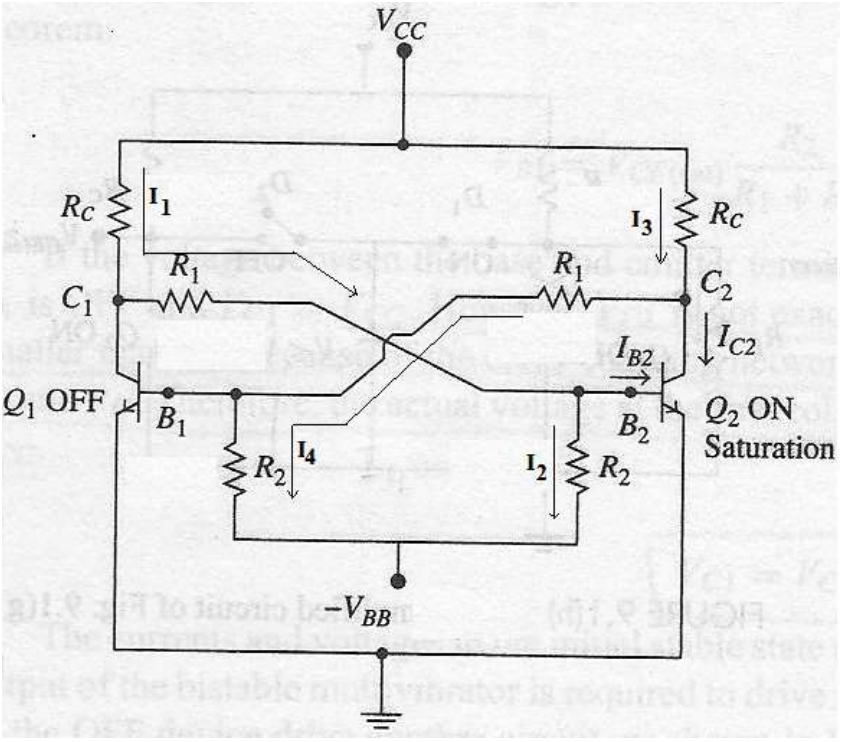
R1	C1	R2	Vb1	Vc1	Vb2	Vc2	Q1	Q2
S.C			Vc2=0.2	Vcc	>0.7	VceSat	off	on
O.C			<0.7 or −Vbb?	Vcc	>0.7	VceSat	off	on
	S.C		>0.7 or Vce−IR1	Vb2	>0.7	VceSat	off	on
	O.C							
		S.C						
		O.C						

Answer the following multiple choice questions:

1) **The base emitter voltage in a saturation region is_____**
   a) Greater than 7V
   b) Almost to 0.7V
   c) Less than 0.7V
   d) Cannot be predicted
2) **Bistable circuit is also known as _____**
   a) Latch
   b) Gate
   c) Flip-flop
   d) Bidirectional circuit
3) **What is a square wave generator?**
   a) Flip-flop
   b) Bi-stable multivibrator
   c) Astable multivibrator
   d) Monostable multivibrator
4) **Monostable multivibrators can be used as**
   a) Pulse generator
   b) Pulse stretcher
   c) Pulse looser
   d) Pulse motor

Question 6:

Design a fixed-bias binary multivibrator with h_{FE} = 50.
The circuit parameters are V_{CC} = 12v, V_{BB} = -12v, I_C = 5 mA, $V_{CE\,(sat)}$ = 0.3v, $V_{BE(sat)}$=0.7v.



Symbol	Formula / Condition	Calculation / Result	Units
R_C			
I_2			
R_2			
$I_{B2(min)}$			
$I_{B2(sat)}$			
I_1			
$I_{B\,(min)}$			
V_{B1}			

Question 7: [Logic Gates]

Draw the following Circuits and Complete The Truth Tables:

PMOS NOR gate:

V_1	V_2	O/P
Low	Low	
Low	High	
High	Low	
High	High	

CMOS NAND:

V_1	V_2	O/P
Low	Low	
Low	High	
High	Low	
High	High	

74 series two input Transistor Transistor Logic NAND Gate:

V_1	V_2	O/P
Low	Low	
Low	High	
High	Low	
High	High	