Code No: RT31041 **R13** SET - 1

III B. Tech I Semester Regular/Supplementary Examinations, October/November- 2017

PULSE AND DIGITAL CIRCUITS

(Common to Electronics and Communication Engineering and Electronics and Instrumentation Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	Determine the upper 3-dB frequency for low pass RC circuit, if a pulse of 0.5μsec is required to pass without distortion. Find the value of resistance if the capacitor is 0.001μF.	[4M]
	b)	Draw the diode based negative clipper and draw its waveforms	[3M]
	c)	Give the Comparison of various logic families	[4M]
	d)	Draw and explain the fixed bias transistor bistable multivibrator	[3M]
	e)	Draw the constant current sweep circuit and explain	[4M]
	f)	Explain the principle of synchronization with frequency division	[4M]

PART –B

2	a)	Explain clearly with the help of a circuit and waveforms the response of high pass RC circuit for step and pulse input	[8M]
	b)	Explain (i) the working of attenuator as a CRO Probe ii) Ringing circuit	[8M]
3	a)	Compare and contrast series diode clipper and shunt diode clipper	[8M]
	b)	In a shunt clipper circuit $v_{in}=20\ sin\ wt$, R=1KΩ, and V_R=10V is obtained from a potential divider circuit using 100 V supply and 10 KΩ potential divider. i) Draw the circuit ii) If R_f = 50 Ω and R_r = ∞ and V_γ = 0 , Sketch the input and output waveforms.	[8M]
4	a)	Explain how transistor acts as a switch? Draw the base and collector waveforms by indicating all the time intervals.	[8M]
	b)	Realize a two-input NAND gate using diode transistor logic and explain its operation with the help of truth table.	[8M]
5	a)	Design a collector-coupled monostable multivibrator using an n-p-n silicon transistor with $h_{FE(min)} = 40$, $V_{BE\ (cut\ off)} \approx 0$ V and $I_{B(sat)} = 1.5I_{B(min)}$. Given that: V_{CC} = 10 V, $I_{C(sat)}$ = 5 mA, $R_{C1} = R_{C2} = R_C$, $V_{CE(sat)}$ = 0.2 V and $V_{BE(sat)}$ = 0.7 V. If the pulse width required is 1 ms, calculate the value of C.	[8M]
	b)	Derive expression for the pulse width of a monostable multivibrator	[8M]
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6 a) Explain the basic principle of a bootstrap sweep generator. Draw the circuit and explain its operation. Derive the expression for its slope error. [8M]

b) Design a relaxation oscillator to have 5kHz output frequency using a UJT and a 20 V power supply. Calculate the sweep amplitude. [8M]
Given that η =0.7, Iv = 1.5 mA, I_P = 8 μA and $V_{EB(sat)}$ = 3 V

7 a) Explain how the loading of the control signal is reduced when the number of inputs increases in a sampling gate. [8M]

b) How to cancel the pedestal in a sampling gate? Discuss with suitable circuit diagram. [8M]

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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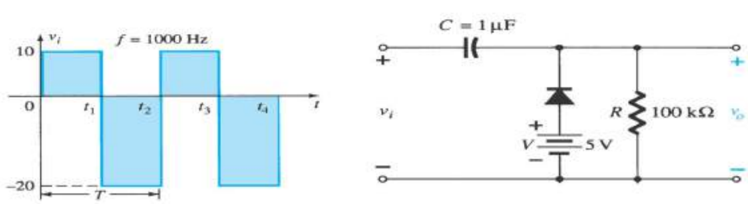
PART –A

1 a) For a high pass RC circuit it is desired to pass a 5 m sec sweep for a ramp input, with less than 0.5% transmission error. Determine the highest possible value of the lower 3-dB frequency. [3M]
b) Draw the diode based positive clipper and draw its waveforms [4M]
c) Present the piecewise linear characteristics of a diode [3M]
d) Explain about commutating capacitors in bistable multi vibrator [4M]
e) Compare voltage and current time base generators [4M]
f) Define phase delay and phase jitter [4M]

PART –B

2 a) Explain the working of a piece- wise linear model of diode. [8M]
b) A two input NAND gate has Vcc=+5V and 1 KΩ load connected to its output? Calculate the output voltagei)When both input are Low ii)when both input are High. [8M]

3 a) Draw the emitter coupled clipper, explain its operation and discuss its transfer characteristics. [8M]
b) Determine v_0 for the following circuit with the input shown and draw the output waveform (consider ideal diode). [8M]



4 a) Derive an expression for collector-to-emitter breakdown voltage, with open circuited base, BV_{CEO} in terms of collector-to-base breakdown voltage, with open circuited emitter, BV_{CBO} [8M]
b) Realize a three-input NAND gate using transistor transistor logic and explain its operation with the help of truth table. [8M]

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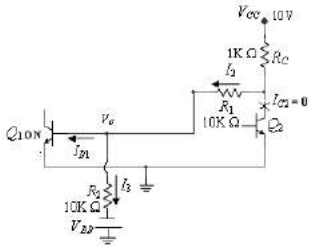
5 a) For a collector-coupled monostable multivibrator circuit shown in Figure , $R_1 = R_2 = R = 10$ kΩ, $C = 0.01$ μF, $R_C = 1$ kΩ, $V_{CC} = 10$ V, $h_{FE} = 20$. In the quasi-stable state, Q_1 is in the active region with collector current of 2 mA. Find the time period and the value oV_{BB}. Neglect junction voltages. $I_{B(sat)} = 1.5I_{B(min)}$. [8M]



b) Discuss the design of fixed bias bistable multivibrator. [8M]

6 a) With suitable diagram, explain the function of sweep circuit using UJT. [8M]

b) With neat circuit, explain about transistor miller time base generator. [8M]

7 a) Draw and explain with relevant waveforms the process of frequency division by an Astable multivibrator [8M]

b) Explain the function of a sampling gate used in Sampling Scopes also explain how sampling gate is used in chopping amplifiers. [8M]

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Code No: RT31041 **R13** SET - 3

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1 a) For a low pass RC circuit it is desired to pass a 3 msec sweep for a ramp input, with less than 0.5% transmission error. Determine the highest possible value of the upper 3-dB frequency. [4M]

b) Draw the diode based positive clamper and draw relevant waveforms [4M]

c) Give the comparison between TTL and CMOS families [3M]

d) Compare all the three multivibrators with corresponding circuits [4M]

e) Why the time base generators are called as sweep circuits? [3M]

f) Draw and explain the operating principle of bidirectional sampling gates [4M]

PART –B

2 a) A symmetrical square wave of peak to peak amplitude V Volts and frequency f Hz is applied to a high pass RC circuit, show that the percentage tilt is given by $P = \frac{1-e^{-1/2fRC}}{1+e^{-1/2fRC}} \times 200\%$ [8M]

b) Analyze the low pass RC circuit for the exponential input with help of waveforms. [8M]

3 a) Design a diode clamper to restore a dc level of +3 Volts to an input signal of peak to peak value 12 Volts. Assume the drop across diode as 0.7 Volts. [8M]

b) Discuss in detail the effects of diode characteristics on clamping voltage. [8M]

4 a) Explain the saturation parameters of transistor and their variation with temperature [8M]

b) A silicon transistor has $h_{FE}=50$, $I_{CO}=0.1\mu A$, the cut-in voltage $V_\gamma=0.6V$. The parameter 'n' of avalanche multiplication is 4 and BV_{CBO}=40V. [8M]

i) Find BV_{CEO}

ii) Find BV_{CER} if $R_B=1M\Omega$

iii) Find BV_{CEX} , assume $V_{BB}=20V$ and $R_B=10K\Omega$

5 a) Design a symmetric collector-coupled astable multivibrator to generate a square wave of 10 kHz having peak-to-peak amplitude of 10 V where, h_{FE}min = 30, $V_{CE(sat)}$ = 0.2 V, $I_{C(sat)}$ = 2 mA. [8M]

b) Prove that an astable multivibrator works as voltage to frequency converter [8M]
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6 a) How can represent deviation from linearity in sweep circuits? Derive the relationamong possible errors in sweep circuits. [8M]

b) The specifications of UJT are given as η =0.6, Vv = 2 V, R_{BB} = 5 kΩ, Iv = 1.5 mA, I_P = 8 μA and V_{BB} = 18 V. Calculate the component values of the UJT sweep circuit to generate an output sweep frequency of 10 kHz with sweep amplitude of 12 V. [8M]

7 a) Explain Synchronization of a sweep circuit with symmetrical signals [8M]

b) Compare unidirectional and bidirectional sampling gates [8M]

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Code No: RT31041 **R13** SET - 4

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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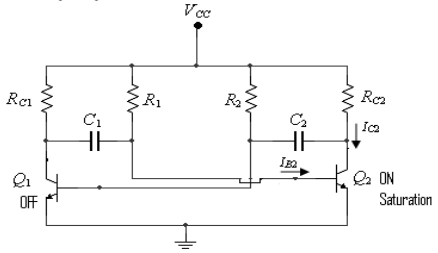
PART –A

1	a)	Show that the low pass RC circuit acts as an integrator	[3M]
	b)	Draw the diode based negative clamper and draw relevant waveforms	[4M]
	c)	Draw and explain the basic CMOS inverter circuit	[3M]
	d)	Draw the Schmitt trigger circuit and discuss its operation	[4M]
	e)	What are different methods of generating time base waveform	[4M]
	f)	Compare sampling gates with logic gates	[4M]

PART –B

2	a)	A 2 KHz symmetric square wave of ±20 V is applied to a RC circuit having 2 msec. time constant. Calculate and plot the output to the scale for RC configuration as. i) High pass circuit ii) Low pass circuit.	[8M]
	b)	Draw explain the RLC circuit that can generate nearly undamped oscillations and explain its working.	[8M]
3	a)	Draw the diode differentiator comparator and discuss its working with the help of ramp input signal	[8M]
	b)	State and prove clamping circuit theorem.	[8M]
4	a)	With neat sketches and necessary equations, explain in detail about transistor switching times	[8M]
	b)	Realize NAND and NOR gates using CMOS logic and explain their operation with the help of truth table.	[8M]
5	a)	Design an unsymmetrical astable multivibrator shown in Figure, using silicon n– p–n transistors having an output amplitude of 12 V. Given, $I_{C(sat)}$ = 5 mA, h_{FEmin} = 50, f = 5 kHz, duty cycle = 0.6.	[8M]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b) Calculate the component values of a monostable multivibrator using silicon *npn* transistors generating an output pulse of 150 µsec. duration. Given ($h_{fe})_{min}$=30, I_C(sat)=6mA,V_{CC}=6V and V_{BB}= -1.5V. If r'$_{bb}$=100Ω, find the magnitude of the overshoot. [8M]

6 a) Draw and explain the transistorized constant current sweep generator circuit. Derive expression for slope error and sweep voltage. [8M]

b) How a compensation circuit improves the linearity of a Bootstrap voltage time base generator? Discuss. [8M]

7 a) What is synchronization? Why it is necessary in waveform generators? Explain the synchronization of a sweep circuit with symmetrical signals. [8M]

b) Write an account of bidirectional diode based sampling gates [8M]

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