



S.No	Question	Bloom Taxonomy Level	Course Outcome
UNIT-I LINEAR WAVE SHAPING			
1	Name the signals which are commonly used in pulse circuits and define any five of them?	Remember	1
2	Define linear wave shaping?	Remember	1
3	Define attenuator and types of attenuator?	Remember	1
4	Explain the fractional tilt of a high pass RC circuit. Write the Expression?	Understand	1
5	State the lower 3-db frequency of high-pass circuit?	Remember	1
6	Distinguish between the linear and non-linear wave shaping circuits.	Remember	1
7	Justify the reason for double differentiation circuit as rate-of-rise amplifier.	Evaluate	1
8	Show that a high pass circuit with a small time constant acts as differentiator?	Apply	1
9	Define Rise time? Give the relations between rise time and bandwidth?	Remember	1

10	Show that a low pass circuit with a time constant acts as Integrator?	Apply	1
11	Name a wave shaping circuit which produces a Ramp wave as an output by taking a step signal as input and draw its output for a sinusoidal wave	Remember	1
12	Write the expressions for the output of a low pass circuit by a step and symmetrical square waves?	Apply	1
13	Solve that for any periodic input wave form the average level of the steady state output signal from an RC high pass circuit is always zero.	Apply	1
14	Explain the response of a high pass RC circuit to a step input signal?	Understand	1
15	Name a wave shaping circuit which produces a Ramp wave as an output by taking a step signal as input and draw its output for a sinusoidal wave	Remember	1
16	Write the expressions for the output of a low pass circuit by a step and symmetrical square waves?	Apply	1
17	Set up by direct integration that the area under the pulse is same as the area under the output waveform across the capacitor.	Apply	1
18	Define peaking Circuit? Write the drawbacks of RL linear wave shaping circuit compared to RC circuit?	Remember	1
19	List out the reasons for preferring integrators over differentiators in Analog computer applications?	Remember	1
20	a) Write the expression for gain and phase when sinusoidal signal is passed through RC Low pass circuit. b) Define Percentage Tilt and Rise time?	Apply Remember	1
UNIT-II			
NON LINEAR WAVE SHAPING			
1	Define non-linear wave shaping? List out the names of nonlinear wave shaping?	Remember	2
2	Distinguish between the comparator and clipping circuit?	Understand	2
3	Justify that a clamping circuit is a dc inserter	Evaluate	2
4	State the clamping circuit theorem	Remember	2
5	State the relationship between R and the forward resistance R_f and reverse resistance R_r of the Clipping Circuit	Remember	2
6	Define Series clipper and shunt clipper	Remember	2
7	Express the meaning of transmission region and attenuation region of a Clipping Circuit	Understand	2
8	List out the two regions of operation of a transistor that are used in a transistor Clipping Circuit.	Remember	2
9	Justify that a clamping Circuit is a Non-linear Wave Shaping Circuit?	Evaluate	2
10	Define Series Noise Clipper and Shunt Noise Clipper?	Remember	2
11	Write the applications of Clamping Circuit	Apply	2
12	Draw the circuit diagram of Slicer? Explain its Operation	Understand	2
13	List the other names that are used for describing the clipping Operation?	Remember	2
14	Mention few applications of clipping and clamping circuits.	Apply	2
15	Mention the applications of comparator.	Apply	2
16	Define the terms of Breakpoint and Transfer Characteristics?	Remember	2
UNIT III			
STEADY STATE SWITCHING CHARACTERISTICS OF A DEVICES & SAMPLING GATES			
1.	Define an ideal diode? Draw the V-I characteristics of a diode?	Remember	6
2.	Name the devices that can be used as switches? Draw the Practical and piece-wise linear diode V-I characteristics?	Remember	6
3.	Define Forward recovery time and reverse recovery time?	Remember	6
4.	Define Storage time and Transition time of a diode?	Remember	6

5.	Explain how a Diode can be used as a switch?	Apply	6
6.	Solve that the total turn-on time of a transistor is the sum of the delay and rise time?	Apply	6
7.	Define Avalanche Breakdown and Zener breakdown?	Remember	6
8.	Write the Expressions for the Static and dynamic resistance of a diode?	Apply	6
9.	List the temperature dependence of Transistor saturation parameters.	Remember	6
10.	Describe the operation of chopper amplifier?	Understand	6
11.	Name the circuit in which the output is an exact reproduction of input during selected time interval and zero otherwise?	Remember	6
12.	Identify the Specific advantages and disadvantages of diode Sampling gate	Understand	6
13.	List the other names that are used for describing the Sampling gates?	Remember	6
14.	Define a pedestal in sampling gate?	Apply	6
15.	Differentiate between sampling gates and logic gates?	Analyze	6
16.	Compare Unidirectional and bidirectional Sampling gates	Analyze	6
17.	Give some applications of Unidirectional Sampling gates	Understand	6
18.	Illustrate the principle of sampling gates with series and parallel switches and compare them.	Analyze	6

**UNIT IV
MULTIVIBRATORS & TIME BASE GENERATORS**

1	Define Multivibrator? Point out the different types of Multivibrator?	Remember	3
2	Distinguish between Stable state and a Quasi Stable state in a Multivibrator?	Understand	3
3	List the other names for describing the Bistable Multivibrator?	Remember	3
4	Define Settling time, transition time in a Bistable Multivibrator	Remember	3
5	Justify to state that the resolving time is the sum of the transition time and the Settling time?	Evaluate	3
6	Discuss the different methods of Triggering or flip-flop?	Understand	3
7	Explain the role of Commutating Capacitors?	Evaluate	3
8	Is Bistable multi a flip-flop, justify	Apply	3
9	State the difference between Symmetrical and unsymmetrical triggering circuit in Bistable.	Apply	3
10	How the effect of loading over come in Bistable Multivibrator.	Understand	3
11	Write the Expression for Maximum frequency of Bistable Multivibrator?	Understand	3
12	List the other names for the monostable Multivibrator?	Remember	3
13	Classify the Multivibrator based on coupling elements used to generate regenerative feedback?	Understand	3
14	Write any two methods to eliminate the Hysteresis in Schmitt Trigger?	Remember	3
15	Write the expression of pulse time in Monostable Multi	Remember	3
16	Define terms UTP and LTP?	Remember	3
17	Compare the voltage and current time base generator? Give examples	Apply	3
18	Define the term Recovery Time for Astable Multivibrator?	Remember	3
19	Write the expression of frequency of Oscillations in Astable Multi	Apply	3
20	Show that an astable Multivibrator is also called square Wave generator?	Apply	3
21	Which amplifier is used in miller time base generator?	Apply	4
22	What are commutating capacitors? Why are they required?	Apply	3
23	What is the best method of triggering a binary unsymmetrically?	Apply	3

24	Name the circuit whose output is a signal with a duty cycle of 50% for a input signal which is an output of oscillator?	Remember	3
25	Why is monostable multivibrator also called a delay circuit?	Remember	3
26	Which device can be used as a switch in sweep circuits? Write the expression for sweep time of sweep circuit constructed with above device?	Apply	4
27	Write the Expression for Sweep speed in the exponential charging of a capacitor	Apply	4
28	Write the Expression for slope error of a miller time base generator	Apply	4
29	Compare the miller time base generator and bootstrap time base generator?	Apply	4
30	Write the Expression for slope error of a bootstrap time base generator	Apply	4
UNIT-V			
SYNCHRONIZATION AND FREQUENCY DIVISION&LOGIC FAMILIES			
1	Define Relaxation circuit? Give Some examples.	Remember	5
2	Define Synchronization? List the different types of Synchronization?	Remember	5
3	Name some negative resistance devices used as relaxation Oscillator?	Remember	5
4	Define the terms Sweep time and Restoration time?	Remember	5
5	Define phase delay and phase jitter?	Remember	5
6	Distinguish between Synchronization and synchronization with frequency division?	Understand	5
7	Compare Sine wave synchronization with pulse synchronization	Evaluate	5
8	Illustrate the condition to be met for pulse synchronization	Apply	5
9	Give the classification of logic families	Understand	7
10	Mention the classification of saturated bipolar logic families	Apply	7
11	Define Fan-out,Fan in, Propagation delay and Power dissipation?	Remember	7
12	Name the three types of TTL gate	Understand	7
13	Draw the waveform at the base of the monostable relaxation circuit to show the frequency division.	Apply	5
14	Point out the advantages and disadvantages of totem pole configuration	Apply	7
15	Give some merits and demerits of ECL?	Apply	7
16	Write the two characteristics of ECL gates?	Remember	7
17	Identify the logic family for simple and Most complex fabrication?	Apply	7
18	Draw the circuit diagram of diode resistor logic AND gate?	Apply	7

GROUP - II (LONG ANSWER QUESTIONS)

S. No.	Question	Bloom Taxonomy Level	Course Outcome
UNIT-I			
LINEAR WAVE SHAPING			
1.	Explain the response of RC High Pass circuit for the following input waveforms A) Step B) Pulse	Understand	1
2.	Derive the expression for a %tilt of a square wave after passing through a high pass RC Circuit. (or) A symmetrical square wave of peak -to-peak amplitude `V' and frequency `f' is applied to a high pass circuit. Show that the percentage tilt is given by $P = 1 - e^{(-1/2RC)} / 1 + e^{(-1/2RC)} * 100\%$:	Analyze	1
3.	With the circuit diagram and waveforms explain the operation of RC circuits as Integrators and differentiators for a square wave input	Evaluate	1
4.	Explain the response of RC low pass circuit for exponential input signal	Understand	1
5.	Prove that for any periodic input wave form the average level of the steady state output signal from an RC high pass circuit is always zero.	Evaluate	1
6.	a) Explain the response of RL circuit when a step input signal is applied? b) Obtain the response of RC high pass circuit for an exponential i/p signal.	Understand	1
7.	Why does a resistive attenuator need to be compensated? Explain different methods of Compensation. What is the effect of the output resistance of the generator on an attenuator output	Apply	1
8.	Describe the relationship between rise time and RC time constant of a low pass RC circuit.	Understand	1
9.	Draw the different output waveforms of a RC Low Pass circuit when it is applied with Different inputs like (a) Step-voltage input (b) pulse input C) Square input	Apply	1
10.	When does an RLC circuit function as a ringing circuit? What is the relationship between Quality factor Q and the number of cycles N in the response of this circuit?	Remember	1
11.	Explain about RL and RLC series Circuits When the input is step is applied	Apply	1
12.	Explain double differentiator with the help of neat sketches	Remember	1
13.	a) Compare linear wave shaping with Nonlinear wave shaping. b) Describe the relationship between rise time and RC time constant of a low pass RC	Analyse	1
UNIT-II			
NON LINEAR WAVE SHAPING			
1.	State and prove the clamping circuit theorem	Remember	2
2.	Give the circuits of different types of shunt clippers and explain their operation with the help of their transfer characteristics?	Understand	2
3.	Explain positive peak clipping without reference voltage.	Understand	2
4.	Explain about positive peak voltage limiters above reference level.	Understand	2
5.	Draw the basic circuit diagram of positive peak clamper circuit and explain its operation.	Understand	2
6.	Draw the basic circuit diagram of a DC restorer circuit and explain its operation. Sketch the output wave form for a sinusoidal input.	Apply	2
7.	Explain the response of the clamping circuit when a square wave input is	Apply	2

	applied under steady state conditions.		
8.	Mention the effects of diode characteristics on clamping voltage.	Apply	2
9.	Give the circuits of different types of shunt clippers and explain their operation with the help of their transfer characteristics.	Remember	2
10.	Draw the circuit diagram of an emitter-coupled clipping circuit and draw its transfer characteristic indicating all intercepts, slopes and voltage levels.	Apply	2
11.	Compare series diode clipper and shunt diode clipper.	Analyze	2
12.	What is synchronized clamping? Explain.	Apply	2
13.	Analyze the diode comparator circuit. Draw the response of the circuit to a ramp input $V_i = I_t$.	Analyze	2
14.	With the help of neat Circuit diagram, explain the working of Transistor Clipper?	Apply	2
15.	Explain in brief about Practical Clamping?	Understand	2
16.	Explain the response of the clamping circuit when a square wave input is applied under steady state conditions.	Understand	2
17.	Draw the diode shunt clipper that clips the sine wave signal above +5V and below -5V.	Apply	2

UNIT-III
STEADY STATE SWITCHING CHARACTERISTICS OF DEVICES & SAMPLING GATES

1.	Explain the storage and transition times of the diode as a switch.	Understand	6
2.	Describe the switching times of BJT by considering charge distribution across the base region. Explain this for cut-off, active and saturation region..	Evaluate	6
3.	Define the different switching times of a transistor with suitable collector current Versus time characteristics.	Understand	6
4.	Explain the temperature sensitivity parameters of a transistor	Evaluate	6
5.	Explain the saturation parameters of a transistor	Apply	6
6.	Illustrate the principle of sampling gates with series and parallel switches and compare them.	Apply	6
7.	Explain how a transistor can be used as a switch. (b) Explain the phenomenon of 'Latching' in a transistor switch	Apply	6
8.	Explain the operation of Four diode Alternative form bidirectional Sampling gate	Understand	6
9.	Derive expressions for gain and minimum control voltages of a bidirectional two- diode sampling gate	Apply	6
10	Illustrate with neat circuit diagram, the operation of unidirectional sampling gate for multiple inputs.	Understand	6
11	a) Why the sampling gates are called linear gates? (b) Compare the unidirectional and bi-directional sampling gates.	Understand	6
12	Explain the effect of control voltage on gate output of unidirectional sampling gate using diode with some example	Understand	6
13	Explain the basic principles of sampling gates using series switch and also give the applications of sampling gate	Understand	6
14	Draw the circuit of two-diode bi-directional sampling gate. Explain its operation & derive expressions for gain and minimum control voltage in the circuit..	Evaluate	6
15	Explain the operation of chopper Amplifier and Sampling Scope.	Remember	6
16	Draw the circuit of FOUR-DIODE sampling gate. Derive expressions for its gain (A) and V_{min} .	Understand	6

UNIT IV			
MULTIVIBRATORS & TIME BASE GENERATORS			
1.	a) Explain the operation of bistable multivibrator circuit with circuit diagram and waveform b) Why collector catching diodes are used in multi vibrators?	Understand	3
2.	Explain how a compensation circuit improves the linearity of a Bootstrap voltage time base generator.	Understand	3
3.	Explain with the help of neat circuit diagram the principle of operation of monostable multivibrator, and derive an expression for pulse width. Draw the wave forms at collector and Bases of both transistors? What is monostable multivibrator?	Understand	3
4.	Draw the various wave shapes of the astable multi vibrator.	Apply	3
5	Explain the basic principles of Miller and Bootstrap time base generators.	Understand	4
6	Define the terms slope error, displacement error and transmission error of time-base signal	Remember	4
7	With the help of a neat circuit diagram and waveforms explain the working of a transistor Miller time base generator.	Analyze	4
8	Explain how to draw the various waveforms and calculate their volatage levels in an emitter-coupled monostable multi.	Understand	4
9	An exponential sweep results when a capacitor is charged from a supply voltage V through a resistor R. If the peak sweep voltage is V_s , derive an expression for stope error (es).	Analyze	4
10.	Draw the circuit of a linear current sweep and explain its operation with waveforms. Explain the necessity of generating trapezoidal waveform.	create	4
11.	Explain the operation of Fixed-Bias Bistable multivibrator with circuit diagram and waveforms.	Understand	3
12.	Explain the working of a Selfbias Bistable multivibrator circuit with the help of waveforms and circuit diagram.	Understand	3
13.	Distinguish between unsymmetrical and Symmetrical triggering? Why it is used?	Analyze	3
14.	Explain different triggering methods of binary circuits.	Understand	3
15.	Explain how Schmitt trigger circuit act as a switch.	Understand	3
16.	(a) Draw and clearly indicate the restoration time and flyback time on the typical waveform of a time base voltage. (b) Derive the relation between the slope, transmission and displacement errors	Analyze	4
17.	Define sweep speed error, transmission error and displacement error pertaining to sweep circuits. Also derive the expressions for the same with respect to an exponential sweep circuit. How are linearly varying current waveforms generated?	Remember	4
18.	With the help of neat diagram explain the working of transistor Bootstrap time base generator	Apply	4
19.	Write the differences between the voltage and current time base generators?	Understand	4
20.	Draw the circuit diagram of transistor Miller time base generator and explain its working.	Apply	4
21	Derive the expression for gate width of a Monostable Multivibrator neglecting the reverse saturation current I_{CBO} ?	Analyze	3
22	With the help of neat circuit diagram and waveforms, explain the working of a collector coupled Astable Multivibrator? Obtain the expression for frequency in Astable Multivibrator	Analyze	3
23	Explain the operation of Astable multivibrator	Understand	3

UNIT-V			
SYNCHRONIZATION AND FREQUENCY DIVISION & LOGIC FAMILIES			
1.	Explain the three input OR gate and explain its operation.	Apply	7
2.	Compare the advantages and disadvantages of transistor and diode logic.	Evaluate	7
3.	Draw a TTL NAND gate and explain its operation	Apply	7
4.	Draw a three input AND gate and verify its truth table using diodes & resistors.	Apply	7
5.	Draw the inverter using transistor and explain its working.	Apply	7
6.	Draw the circuit diagram of diode - resistor logic AND and OR gate and explain its operation.	Apply	7
7.	What do you mean by a relaxation circuit? Give a few examples of relaxation circuits.	Apply	5
8.	With the help of neat waveforms, explain sine wave frequency division with a sweep circuit.	Apply	5
9.	Explain the principle of "synchronization" and "synchronization with frequency division".	Understand	5
10.	Explain the method of pulse synchronization of relaxation devices, with examples.	Understand	5
11.	With neat circuit, waveforms explain the frequency division in monostable multivibrator.	Apply	5
12.	Define the terms phase delay and phase jitter. What is the condition to be met for pulse synchronization?	Remember	5
13.	Compare TTL and RTL logic and Draw the Transistor logic NAND gate and explain its operation.	Evaluate	7
14.	a) Compare the pulse synchronization and synchronization with symmetrical signals b) Explain the importance of synchronization in digital circuits	Evaluate	7
15.	Draw the circuit diagram of NAND, NOR gate using DTL logic and explain	Apply	7
16.	With the help of a circuit diagram and waveforms, explain frequency division of an astable multivibrator with pulse signals.	Apply	7
17.	What are tri state and totem pole configurations? Explain?	Apply	7

GROUP - C (PROBLEMS)

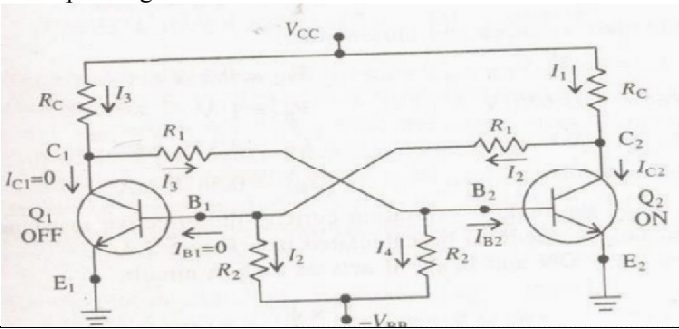
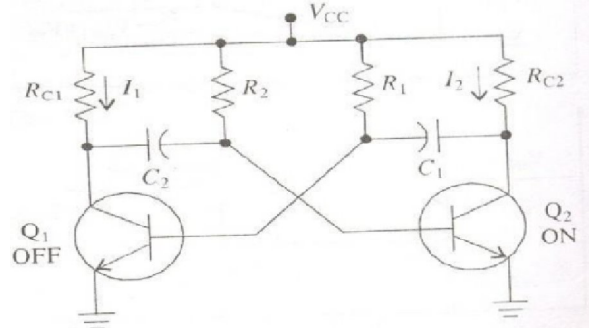
S.No	Question	Blooms Taxonomy Level	Course Outcome
UNIT-I			
LINEAR WAVE SHAPING			
1.	Design a step input of 10V when applied to the Low Pass RC circuit produces the output with a Rise time of 200 micro sec. Calculate the upper 3dB frequency of the circuit if the circuit uses a capacitor of 0.47 micro F, Determine the value of the resistance.	Apply	1
2.	A pulse of 5 V amplitude and pulse width of 0.5 msec is applied to a high pass RC circuit consisting of R=22 K ohms and C= 0.47 micro F. Sketch the output waveform and determine the percentage tilt in the output.	Analyze	1
3.	In an uncompensated attenuator the circuit components values are R1 = 10Kohm, R2=2Kohm, C1=120pF, C2=30pF. Calculate: (i) Rise time when C1 is not connected	Understand	1

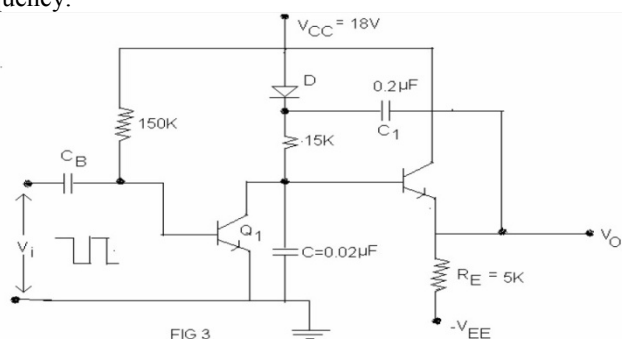
	(ii) For avoiding overshoot calculate the exact value of CI		
4.	Prepare an RC differentiator circuit for pulses of 1 ms repetition and 10V amplitude. The trigger pulses are to have 8 V amplitude. The source resistance is 50ohm and load resistance is 500ohm.	Apply	1
5.	A 1KHz square wave output from an amplifier has rise time $t_r = 250$ ns and tilt = 10%, determine the upper and lower frequencies.	Understand	1
6.	A 10Hz square wave is fed to an amplifier. Calculate and sketch the output wave forms under following conditions. The lower 3db frequency is i. 0.3Hz ii. 3Hz iii. 30Hz	Evaluate	1
7.	A symmetrical square wave whose peak-to-peak amplitude is 2V and whose average value is zero is applied to on RC integrating circuit.		1
	The time constant is equals to half -period of the square wave. Find the peak to peak value of the output amplitude	Apply	1
8.	A square wave whose peak-to-peak value is 1 V, extends 0.5V w.r.t. to ground. The half period is 0.1 Sec this voltage impressed upon an RC differentiating circuit whose time constant is 0.2 sec. Determine the maximum and minimum values of the o/p voltages in the steady state	Evaluate	1
9.	A 10HZ symmetrical square wave whose peak-to-peak amplitude is		1
	2V is applied to a High pass RC circuit whose lower 3-db frequency is 5HZ. Calculate and sketch the output waveform?	Analysis	1
10.	Compute and draw to scale the output waveform for $C = 100$ pf,		1
	$C = 150$ pf and $C = 50$ pf and the input is 25v step with $R_1 = 2M\Omega$, $R_2 = 2M\Omega$, $C_2 = 100PF$?	Apply	1
11.	The limited ramp is applied to an RC differentiates. Draw to scale the output waveform for the case (i) $T = RC$ (ii) $T = 0.2RC$ (iii) $T = 5RC$.	Evaluate	1
12.	Assuming the capacitor to be initially uncharged, determine the output response of the low pass RC circuit with time constant 0.05ms to the input waveform shown in fig given below	Evaluate	1
13.	If a square wave of 5KHz is applied to an RC high pass circuit and the resultant waveform measured on a CRO was tilted from 15V to 10V, find the lower 3-dB frequency of the high pass circuit	Evaluate	1
14.	An oscilloscope displays a 5Hz square wave with 6% tilt. The signal input has no tilt and is coupled to the oscilloscope via a $4.7\mu F$ capacitor. Calculate the input resistance of the oscilloscope.	Analyze	1
15.	A symmetrical square wave is applied to a HP circuit having $R = 20$ k and $C = 0.05 \mu f$. If the frequency of input signal is 1kHz and the signal swings between +0.5V to -0.5V, draw the output wave shape and indicate the voltages, also explain what happens if the input signal frequency is reduced to 100 Hz?	Understand	1
UNIT-II			
NON LINEAR WAVE SHAPING			
1.	A 100V peak square wave with an average value of 0V and a period of 20 ms is to be negatively clamped at 25V. Draw the circuit diagram	Analyze	2

	necessary for this purpose. Also, draw the input and output waveforms.		
2.	The input voltage V_i to the two-level clipper shown in fig2. varies linearly from 0 to 200V. Sketch the output voltage V_o to the same scale 0 as the input voltage	Analyze	2
3.	For the clipper circuit shown in Figure the input $v_i = 60 \sin \omega t$. Calculate and plot to Scale i. The transfer characteristic indicating slopes and intercepts. ii. Input / output on the same scale. Assume ideal diodes.	Apply	2
4.	The input voltage V_i to the clipper shown in figure 7b below is a 10 micro sec pulse whose voltage varies from 0V to 10V.	Apply	2
5.	If $R_f = 100$, $V_T = 0.5$ V and $R_r = \infty$ for the diode, sketch the output waveform V_o and indicate the time constants of the exponential portions.	Understand	2
6.	Design the value of Resistance R in clipper circuit when forward Resistance of diode is 10k and reverse resistance of diode is 100k	Apply	2
7.	Draw the circuit of a shunt diode positive peak clipper. Assume $R_f = 50\Omega$, $V_T = 0.6$ V, $R_r = 2M\Omega$, $R = 20K\Omega$ and $V_R = +15$ V. Sketch the transfer characteristics when the input voltage varies between -20V and +20V. Indicate the slopes, voltage levels $V_o(\max)$ and $V_o(\min)$ and the region where the diode conducts. Also sketch the input/output waveforms, if a sine wave of 20V peak is applied as an input. If a load resistance of 30K Ω is connected across the output terminals, sketch the transfer characteristics and the output wave for a 20V peak sine wave input?	Analyze	2
8.	A symmetrical 10 KHz square wave whose peak-to-peak excursions are ± 10 V with respect to ground is impressed on the clamping circuit shown below. Here $R = 10K\Omega$, $C = 1\mu F$, the diode has $R_r = \infty$, $R_f = 0$, $V_T = 0$ and the source impedance R_s is zero.	Analyze	2
9.	The input voltage v_i to the two level clipper shown in figure 1 varies linearly from 0 to 150 V. Sketch the output voltage v_o to the same time scale as the input voltage. Assume Ideal diodes.	Analyze	2

10.	Design a diode clamper circuit to clamp the positive peaks of the input signal at zero level. The frequency of the input signal is 500 Hz?	Remember	2
11.	Plot V_o for the circuit shown, assuming ideal diode given $V_i = 20 \sin \omega t$	Remember	2
12.	A 100V peak square wave with an average value of 0V is to be negatively clamped at 25V. Draw the output waveforms?	Apply	2
13.	For the input voltage $V_i = 100V$. Calculate and plot the Steady state output voltage ($T_1 = 100 \mu\text{sec}$, $T_2 = 1000 \mu\text{sec}$, $C = 0.1 \mu\text{F}$, $R = 100K\Omega$, $R_s = 100\Omega$, $R_f = 100\Omega$)	Understand	2
14.	For the circuit shown. V_i is a sinusoidal input voltage of 60V. Assume the ideal diodes, Sketch one cycle of output voltage. Determine the maximum diode currents	Analyze	2
UNIT-III			
STEADY STATE SWITCHING CHARACTERISTICS OF DEVICES & SAMPLING GATES			
1.	Design a high speed common emitter transistor switch operating with two power supplies $V_{cc} = 12V$ and $-V_{BB} = -10V$. the transistor is expected to operate at $I_c = 8mA$, $I_B = 0.75mA$. The static current gain h_{FE} of the transistor is 30, $V_{BE(sat)} = 0.3V$, and $R_2 = 3R_1$. Determine the values of the three resistors R_c, R_1, R_2 .	Analyze	6
2.	A germanium transistor is operated at room temperature in the CE configuration. The supply voltage is 6 V, the collector-circuit resistance is 200 and the base current is 20 percent higher than the minimum value required to drive the transistor into saturation. Assume the following transistor parameters: $I_{co} = -5\mu A$, $I_{EO} = -2\mu A$, $h_{FE} = 100$, and $r_{bb} = 250$. Find $V_{BE(Sat)}$ and $V_{CE(Sat)}$.	understand	6

3.	<p>Calculate the output levels of the circuit shown in fig. for the inputs of 0V & -8v and verify that the circuit is an inverter. What is the minimum value of hFE required .Neglect the junction Saturation voltages and assume an ideal diode.</p>	understand	6
4.	<p>The forward voltage across diode is 0.4 V and forward current through it is 10nA at temperature 27 degree Celsius. For forward voltage of .42V the current through diode becomes twice. Calculate the value of I0.</p>	Analyze	6
5.	<p>Design a high speed common emitter transistor switch operating with two power supplies Vcc=12V and -V_BB= -10V. the transistor is expected to operate at Ic= 8mA, I_B=0.75mA.The static current gain h_FE of the transistor is 30, V_BE(sat) = 0.3V, and R_2=3R_1.Determine the values of the three resistors Rc, R_1 ,R_2.</p>	Remember	6
6.	<p>Design the Transistor switch (Inverter) for the following specifications Vin= ±3Vsquare wave, VCC=10V, IC=1mA, hFE=50.Assume Si transistor?</p>	Analyze	6
8.	<p>Design a transistor inverter circuit (NOT gate) with the following specifications: VCC = VBB = 10V,ICsat = 10mA; hfemin = 30; the input is varying between 0 and 10V. Assume typical junction voltages of npn silicon transistor</p>	Evaluate	6
9.	<p>Assume Vs = 20V, Rf = 25Ω, RL = Rc = 100KΩ. Calculate i) Gain (A) ii) Minimum positive control voltage (VCP)min iii) Minimum negative control voltage (Vcn)min for four diode sampling gate?</p>	Apply	6
10.	<p>Determine the gain A, minimum values Vmin and Vn(min) applicable to the four diode bi-directional sampling gate. The signal amplitude Vs=24v and assume that Rz=2.7k, RL=RC=120K, and the forward resistance of all the diodes Rf is assumed to be 25. If the biasing voltage on either side of this circuit full the condition V=Vmin. Determine the minimum value(Vc)min</p>	Evaluate	6
<p>UNIT IV MULTIVIBRATORS & TIME BASE GENERATORS</p>			
1.	<p>Design a Schmitt trigger circuit using NPN transistors having hFE(MIN) =60 . VBE cut-off = 0V, VCE(Sat) = 0.2V and VBE(Sat) = 0.7V. Given Vcc=8V and o/p swing = 6V, UTP = 3.5V, LTP = 1.5V, R1 = 10K AND R2 = 2K.Determine Rc1, Rc2 and Re</p>	Understand	3
2.	<p>Design a transistor bootstrap ramp generator to provide an output amplitude of 12V over a time period of 2ms. The input signal is a negative going pulse with an amplitude of 5 V, a pulse width of 2ms and the time interval between pulses is 0.5ms. The load resistance is 1K and the ramp is to be linear within 1%. The supply is to be 15V. take hfe(min) = 80.</p>	Apply	3
3.	<p>A fixed bias bistable has the following circuit parameters Rc = 1k, R1 = 3.9k, Vcc = +9v and VBB = -9v. Assume for transistor VCESat = 0v, VBEsat = 0.6v and VBE(cutoff) = 0v A the binary, and _nd the stable state voltages and currents. What is the minimum value of hFE to</p>	Understand	3

	<p>satisfy the ON-OFF condition? Draw the circuit diagram and corresponding waveforms at both collections and bases.</p> 		
4.	<p>A collector coupled Fixed bias binary uses NPN transistors with $hFE = 100$. The circuit parameters are $VCC = 12V$, $VBB = -3V$, $RC = 1k$, $R1 = 5k$, and $R2 = 10k$. Verify that when one transistor is cut-off the other is in saturation. Find the stable state currents and voltages for the circuit. Assume for transistors $VCE(sat) = 0.3V$ and $VBE(sat) = 0.7V$.</p>	Analyze	3
5.	<p>Design a Schmitt trigger circuit using n-p-n silicon transistors to meet the following specifications: $VCC=12V$, $UTP=4V$, $LTP=2V$, $hfe=60$, $Ic2=3mA$. Use relevant assumptions and the empirical relationships</p>	Apply	3
6.	<p>Design a collector coupled astable multivibrator to meet the following Specifications: $f = 10KHZ$, $VCC = 12V$, $Ic(sat)=4mA$ and $hFE(min)=20$. Assume that $VCE(sat)=0.3V$ and $VBE(sat)=0.7V$.</p>	Apply	3
7.	<p>Design an astable multivibrator to generate 5kHz square wave with a duty cycle of 40% and if amplitude 12V. Use NPN transistor having $hFE = 100$, $VBEsat = 0.7V$, $VCEsat = 0.2$, $ICmax = 100mA$. Show the waveforms seen at both the collector and bases.</p> 	Apply	3
8.	<p>Design an astable multi for an o/p amplitude of 15V and square wave frequency of 500Hz. Assume $hFEmin = 50$, $ICsat = 5mA$ and $VCEsat = 0$.</p>	Apply	3
9.	<p>Find the component values of a bootstrap sweep generator, given $VCC=18V$, $Ic(sat) = 2mA$ and $hfe(min)=30$.</p>	Understand	4
10.	<p>A transistor bootstrap ramp generator is to produce a 15V, 5ms output to a 2kohms load resistor. The ramp is to be linear within 2%. Design a suitable circuit using $Vcc = 22V$, $-VEE = -22V$ and transistor with $hfe(min) = 25$. The input pulse has an amplitude of -5V, pulse width = 5ms and space width = 2.5ms.</p>	Understand	4
11.	<p>Silicon transistors with $hfe = 30$ are available. If $Vcc = 12V$ and $VBB= 6V$, design a fixed bias bistable multivibrator.</p>	Understand	3
12.	<p>Consider the Schmitt trigger with germanium transistor having $hfe= 20$. The circuit parameter are $Vcc = 15V$, $Rs = 2k\Omega$, $Rc1= 4k\Omega$, $R1= 1k\Omega = 3k\Omega$, $R2 = 10k\Omega$ and $Re= 6k\Omega$. Calculate LTP and UTP.</p>	Evaluate	3

13.	Design an astable multivibrator to generate a 5kHz square wave with a duty cycle of 60% and amplitude 12v. Use NPN silicon transistors having $h_{FE}(\min) = 70$, $V_{CE}(\text{sat}) = 0.3\text{v}$, $V_{BE}(\text{sat}) = 0.7\text{v}$, $V_{BE}(\text{cutoff}) = 0\text{v}$ and $RC = 2\text{K}$. Draw the waveforms seen at both collectors and bases.	Apply	3
14.	Design a Fixed Bias binary by given following specifications, $V_{CC} = V_{BB} = 12\text{V}$, $h_{fe}(\min) = 20$, $I_{C}(\text{sat}) = 4\text{mA}$ Assume npn si-Transistors	Understand	3
15.	Design a Self Bias binary using si transistors. $V_{CC} = 6\text{V}$, $h_{fe}(\min) = 30$, Assume appropriate junction voltages for your design?	Apply	3
16.	The normal self-biased binary uses npn si transistors having worst-case values of $V_{ce}(\text{sat}) = 0.4\text{V}$, $V_{be}(\text{sat}) = 0.8\text{V}$ and zero base to emitter voltage for cutoff. The circuit parameters are $V_{CC} = 20\text{V}$, $R_{C1} = R_{C2} = 4.7\text{k}\Omega$, $R_1 = 30\text{k}\Omega$, $R_2 = 15\text{k}\Omega$ and $R_e = 390\text{k}\Omega$ a) Find Stable state Currents and Voltages. b) Find the minimum value of h_{fe} required to give the values of part(a) c) As the temperature is increased, what is the maximum value to which I_{cbo} can increase before the condition is reached where neither transistor is OFF.	Analyze	3
17.	A Collector coupled monostable multi using npn si transistors has the same following parameters. $V_{CC} = 12\text{V}$, $V_{BB} = 3\text{V}$, $R_C = 2\text{k}\Omega$, $R_1 = R_2 = R = 20\text{k}\Omega$, $h_{fe} = 30$, $r_{bb}' = 200\Omega$ and $C = 1000\text{pF}$, neglect I_{cbo} . (a) Calculate and plot to scale the wave shapes at each base and collector. (b) Find the width of the output pulse.	Analyze	3
18.	Find the pulse width, period and frequency of output of a astable multivibrator given $R_1 = R_2$ and $100\text{k}\Omega$ and $C_1 = C_2 = 0.1\mu\text{F}$	Apply	3
19.	A bootstrap sweep generator is shown in fig 3. Transistor Q and Q are silicon with $h_{fe} = 30$, $V_{CE}(\text{sat}) = 0.4\text{V}$ and $V_{BE}(\text{sat}) = 0.8\text{V}$. Assume a voltage drop of 0.5V across the forward-biased diode D. Calculate all the quiescent state voltages and currents. If a periodic gating signal with a frequency of 1 KHz and $T_g = 0.5\text{ms}$ is applied, determine the sweep time, sweep amplitude and sweep frequency. 	Understand	4
20.	Design an astable multivibrator to generate a 5kHz square wave with a dutycycle of 60% and amplitude 12v. Use NPN silicon transistors having $h_{FE}(\min) = 70$, $V_{CE}(\text{sat}) = 0.3\text{v}$, $V_{BE}(\text{sat}) = 0.7\text{v}$, $V_{BE}(\text{cutoff}) = 0\text{v}$ and $RC = 2\text{K}$. Draw the waveforms seen at both collectors and bases. Find the component values of a bootstrap sweep generator, given $V_{CC} = 18\text{V}$, $I_{C}(\text{sat}) = 2\text{mA}$ and $h_{fe}(\min) = 30$	Apply	3
21.	Design the Astable Multivibrator to generate 1 KHz square wave. The supply voltage $V_{CC} = 10\text{V}$, $I_{C}(\text{sat}) = 10\text{mA}$, $h_{FE} = 50$ and assume Si transistors.	Apply	3
22.	Design collector coupled fixed-bias Bistable Multivibrator to operate from $\pm 6\text{V}$ supply. Given $I_{C}(\text{sat}) = 1\text{mA}$, $h_{FE} = 35$. Assume Si transistor?	Apply	3

UNIT-V SYNCHRONIZATION AND FREQUENCY DIVISION & LOGIC FAMILIES			
1.	Design a relaxation oscillator to have 3kHz output frequency. Using 2N2646 UJT and a 20V supply. Calculate the sweep amplitude. The specifications from the data sheet are given as $\eta=0.7$, $I_p=2\mu A$, $I_v=1nA$ and $V_{EB;SAT}=3V$.	Apply	5
2.	A UJT sweep operates with $V_v = 3V$, $V_p=16V$ and $\eta=0.5$. A sinusoidal synchronizing voltage of 2V peak is applied between bases and the natural frequency of the sweep is 1kHz, over what range of sync signal frequency will the sweep remain in 1:1 synchronism with the sync signal?	Apply	5
3.	In the UJT sweep circuit, $V_{BB} = 20V$, $V_{yy} = 50V$, $R=5k$, $C=0.01$ micro F. UJT has $\eta = 0.5$. Calculate i. amplitude of sweep signal ii. Slope and displacement errors and iii. estimated recovery time.	Apply	5
4.	The relaxation oscillator when running freely, generates an output sweep amplitude of 100V and frequency 1kHz. Synchronizing pulses are applied such that at each pulse the breakdown voltage is lowered by 20V. Over what frequency range may the synchronizing pulse frequency be varied if 1:1 synchronization is to result?	Apply	5
5.	Design a transistor inverter circuit (NOT gate) with the following specifications: $V_{CC} = V_{BB} = 10V$, $I_{Csat} = 10mA$; $h_{femin} = 30$; the input is varying between 0 and 10V. Assume typical junction voltages of npn silicon transistor	Apply	7
6.	A symmetrical astable multivibrator using germanium transistors and operating from a 10V collector supply voltage has a free period of 1000 nsec. Triggering pulses whose spacing is 750 μ sec are applied to one base through a small capacitor from a high impedance source. Find the minimum triggering pulse amplitude required to achieve 1 : 1 synchronization. Assume typical junction voltage of the transistor and that the timing portion of the base waveform is linear.	Apply	5
7.	A UJT sweep operates with $V_v = 3V$, $V_p=16V$ and $\eta=0.5$. A sinusoidal synchronizing voltage of 2V peak is applied between bases and the natural frequency of the sweep is 1kHz, over what range of sync signal frequency will the sweep remain in 1:1 synchronism with the sync signal?	Apply	5
8.	The transistor inverter (NOT gate) circuit has $h_{femin} = 40$, $V_{cc} = 12V$, $R_c = 2.2k$, $R_1 = 15k$ and $R_2 = 100k$, $V_{BB} = 12V$. The input is varying between 12V and 0V. Assume typical junction voltages of pnp transistor. Prove that this circuit works as NOT gate.	Apply	7