

**II B.Tech. I Semester Supplementary Examinations, May -2005**  
**PULSE AND DIGITAL CIRCUITS**  
( Common to Electrical & Electronic Engineering, Electronics &  
Communication Engineering, Electronics & Telematics and Electronics &  
Computer Engineering)

Time: 3 hours

Max Marks: 80

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. A step generator of 50 ohm impedance applies a 10 V step of 2.2 nsec rise time to a series combination of a capacitor C and a resistance R=50 ohm. A pulse of amplitude 1V appears across R. Find the value of the capacitance C.
2. (a) For a shunt diode clipper circuit  $V_i = 20 \sin \omega t$ ,  $V_R = 10V$  is obtained from a potential divider circuit using 100V supply and 10K potentiometer
  - i. Draw the circuit diagram.
  - ii. If  $R_f = 50 \Omega$ ,  $R_r = \infty$  and  $V_r = 0$ , sketch the transfer characteristic, output waveform for the given  $V_i$ .
- (b) Draw the basic circuit diagram of a DC restorer circuit and explain its operation. Sketch the output waveform for a sinusoidal input signal.
3. (a) Explain in detail the junction diode switching times.  
(b) Give a brief note on piece-wise linear diode characteristics.
4. (a) What is an astable multivibrator? Explain. How does this differ with the other multivibrators?  
(b) Derive an expression for the period of oscillations of astable multivibrator.  
(c) Bring out the effect of supply voltage, Junction voltages and temperature on the period of oscillations of the astable multi.
5. (a) Bring out the necessity and importance of current sweep circuits. List out its applications.  
(b) What are the techniques used to improve the linearity of current sweeps. Illustrate with examples.
6. (a) Illustrate the terms 'synchronization' and 'frequency division' of a sweep generator.  
(b) A free-running relaxation oscillator has sweep amplitude of 100 V and a period of 1 msec synchronizing pulses are applied to the device such that breakdown voltage is lowered by 50 V at each pulse. The synchronizing pulse frequency is 4 kHz. What is the amplitude and frequency of synchronized oscillator waveform?
7. (a) What is a sampling gate? Explain the operation of series gate using JFET. Sketch the input and output waveforms.

- (b) Illustrate the errors encountered in series sampling and what is the design procedure to minimize these errors?
8. Explain with neat circuit diagram of triggered blocking oscillator with emitter timing. Draw the equivalent circuit and show the current and voltage waveforms. Derive an expression for current pulse width.

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1. (a) A symmetrical square wave whose peak-to-peak amplitude is 2V and whose average value is zero is applied to an RC integrating circuit. The time constant is half the period of the square wave. Find the peak-to-peak value of the output amplitude.  
(b) Write a short note on RC low pass circuit. Draw the output if a step input is applied.
2. (a) What is meant by clipping in wave shaping?  
(b) Classify different types of clipper circuits. Give their circuits and explain their operation with the aid of transfer characteristics.
3. Define rise time and fall time of transistor switch. Derive expressions for these in terms of the transistor parameters and operating currents.
4. (a) What is an astable multivibrator? Explain. How does this differ with the other multivibrators?  
(b) Derive an expression for the period of oscillations of astable multivibrator.  
(c) Bring out the effect of supply voltage, Junction voltages and temperature on the period of oscillations of the astable multi.
5. (a) Draw the circuit of a monostable bootstrap time-base generator and explain its working.  
(b) What is the effect of Recovery interval on the sweep output? How do you get minimum recovery time in a bootstrap time base circuit?
6. (a) Bring out the importance of synchronization and frequency division.  
(b) 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?
7. (a) What is a sampling gate? Explain the operation of series gate using JFET. Sketch the input and output waveforms.  
(b) Illustrate the errors encountered in series sampling and what is the design procedure to minimize these errors?

8. What is meant by blocking oscillator? Explain the principle of a operation monostable blocking oscillator with base timing. Sketch the current waveforms and derive an expression for current pulse width.

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1. Compute and draw to scale the output wave form for  $C=50\text{pF}$ ,  $C=75\text{pF}$ , and  $C=25\text{pF}$  if the input is a 20V step for the following circuit.(figure 1)

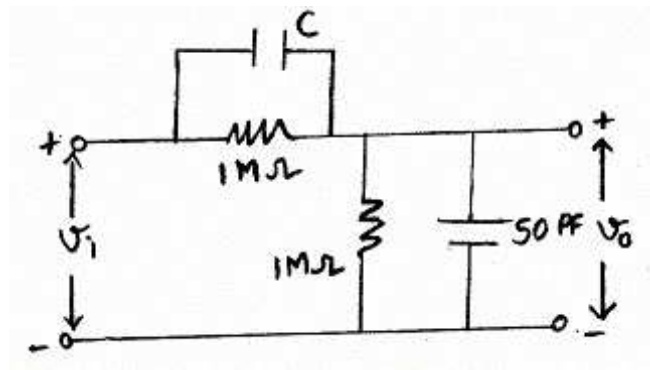


Figure 1:

2. (a) Design a clipping circuit with ideal components, which can give the waveform shown in figure 2 below for a sinusoidal input.

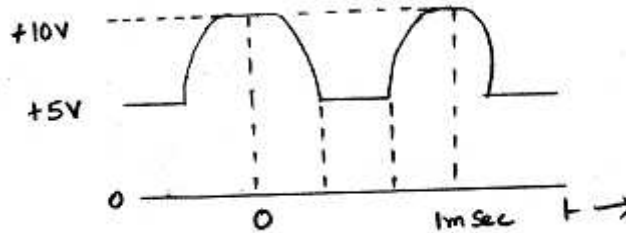


Figure 2:

- (b) Design a diode clamper to restore a d.c level of +3 Volts to an input signal of peak to peak value of 10 Volts. Assume drop across diode is 0.6 Volts. as shown in the figure (figure 3)below
3. (a) Explain how transistor can be used as a switch in the circuit, under what condition a transistor is said to be 'OFF' and 'ON' respectively.
- (b) A germanium transistor is operated at room temperature in the CE configuration. The supply voltage is 6 V, the collector-circuit resistance is  $200\Omega$  and

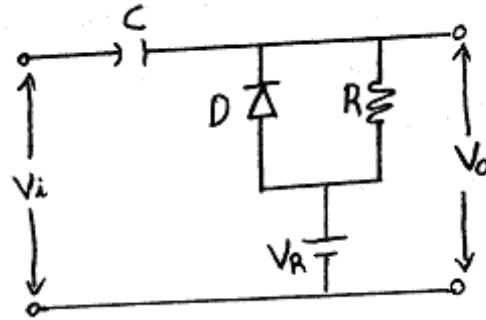


Figure 3:

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  $r_{bb'} = 250\Omega$ . Find  $V_{BE}(\text{Sat})$  and  $V_{CE}(\text{Sat})$ .

4. An emitter-coupled monostable circuit. uses n-p-n transistors with  $h_{fe} = 40$ . Assume that  $r_{bb'} = 0$  &  $V_{CC}(\text{sat}) = V_{BE}(\text{sat}) = 0$ . The circuit parameters are  $V_{CC} = 12V$ ,  $R_{C1} = 3.6K\Omega$ ,  $R_{C2} = 2.2K\Omega$ ,  $R_e = 1K\Omega$  and  $R = 68K\Omega$ . The bias  $V$  is adjusted to midway between the  $V_{min}$  and  $V_{max}$ . A trigger is applied at  $t = 0$  and plot the waveforms at different base and collectors.
5. (a) Explain, how an inductor  $L$  can be used to improve the linearity of a simple RC sweep circuit.  
(b) Compare inductor circuit and constant current circuit to improve the linearity of a sweep.
6. (a) Bring out the importance of synchronization and frequency division.  
(b) 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?
7. (a) Illustrate with neat circuit diagram, the operation of unidirectional sampling gate for multiple inputs.  
(b) Explain with circuit diagram the operation of a two input sampling gate which does not have any loading effect on control signal.
8. Explain with neat circuit diagram of triggered blocking oscillator with emitter timing. Draw the equivalent circuit and show the current and voltage waveforms. Derive an expression for current pulse width.

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1. (a) The input to a high pass RC circuit is periodic and trapezoidal as indicated below. Assume that the time constant  $RC$  is large compared with either  $T_1$  or  $T_2$ . Find and sketch the steady state output if  $RC=10T_1=10T_2$ . (figure 4)

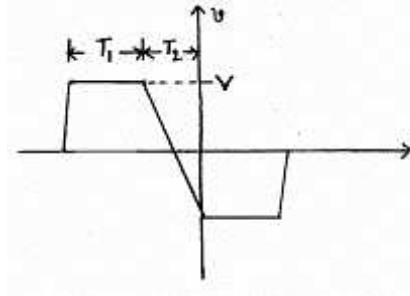


Figure 4:

- (b) Derive the expression for percentage tilt  $P$  of a square wave output of a RC high pass circuit.
2. (a) Draw the circuit diagram of an emitter-coupled clipping circuit and draw its transfer characteristic indicating all intercepts, slopes and voltage levels .
- (b) The input voltage  $V_i$  to the clipper shown in figure 5 below is a 10 micro sec. pulse whose voltage varies between 0 and 10V.

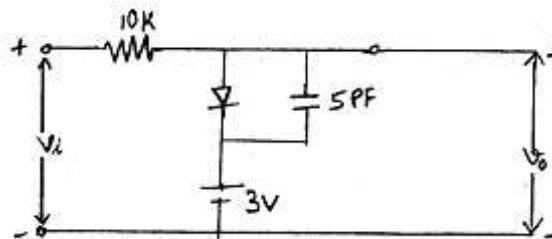


Figure 5:

If  $R_f = 100\Omega$ ,  $V_r = 0.5\text{ V}$  and  $R_r = \infty$ , sketch the output wave form  $V_o$  and indicate the time constants of the exponential portions.

3. Define rise time and fall time of transistor switch. Derive expressions for these in terms of the transistor parameters and operating currents.

4. (a) Discuss the different methods of triggering a flip-flop. Explain the role of commutating capacitors in a binary circuit.  
(b) Draw the circuit diagram of a fixed bias binary with speed up capacitors.
5. (a) Draw the circuit of a constant current sweep circuit and derive the expression for sweep voltage.  
(b) In transistor constant current sweep circuit what happens if temperature is increased? What sort of circuit provides temperature compensation?
6. (a) How astable multivibrator can be synchronized? Illustrate with waveforms.  
(b) A symmetrical astable multivibrator using transistor operates from 10V supply has a period of 1msec. Triggering pulses of spacing 750 microsec 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.
7. (a) Distinguish between logic gate and sampling gate.  
(b) Why is a sampling referred as a linear gate?  
(c) Illustrate the principle of operation of a linear gate using series switch and shunts witch. What are the disadvantages?
8. What is meant by blocking oscillator? Explain the principle of a operation monostable blocking oscillator with base timing. Sketch the current waveforms and derive an expression for current pulse width.

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