Code No: 114DN

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, September/October - 2023
PULSE AND DIGITAL CIRCUITS
(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a) How does the cutoff frequency (f_c) affect the filtering behavior of a low-pass RC circuit? [2]
b) Briefly describe the function of a differentiator circuit in signal processing. [3]
c) Explain the basic function of diode clippers in electronic circuits. [2]
d) How do the forward voltage drop characteristics of a diode affect the clamping voltage in clamping circuits? [3]
e) What is the consequence of an increase in the transistor's base current (I_B) on its switching speed? [2]
f) Differentiate between base-emitter breakdown voltage (V_{BE}) and collector-emitter breakdown voltage (V_{CEO}) in transistors. [3]
g) Define the general features of a time base signal in electronic systems. [2]
h) Briefly explain the operation of an astable multivibrator. [3]
i) Define the concept of frequency division in a sweep circuit. [2]
j) Briefly compare the characteristics of DCTL and TTL logic families. [3]

PART - B

(50 Marks)

2.a) A sinusoidal signal with a frequency of 1kHz is applied to a low-pass RC circuit with R = 2.2kΩ and C = 0.47μF. Calculate the voltage gain at this frequency.
b) Explain the concept of signal drift in an integrator circuit. How can it be mitigated?[5+5]

OR

3.a) Determine the output voltage of a low-pass RC integrator circuit when a square wave input with a peak amplitude of 2V and a frequency of 500Hz is applied. Use R = 2.2kΩ and C = 1μF.
b) Explain the concept of RC time constant. How does it affect the response of an RC circuit to different input signals? [6+4]

4.a) Provide a detailed explanation of how a transistor clipper operates, considering different transistor biasing configurations.
b) Describe a circuit that can clip an input signal at two different voltage levels during both positive and negative half-cycles. [5+5]

OR

5.a) In an emitter-biased transistor clipper circuit, the input is a sinusoidal signal with a peak voltage of 8V. The transistor's emitter voltage is biased at 2V. Calculate the peak voltage of the clipped output for both positive and negative half-cycles.

b) Discuss the factors that need to be taken into account when designing a clamping circuit, considering source resistance and diode characteristics. [5+5]

6.a) Explain the basic principles of operation of an SCR in a switching application.

b) Derive the equation for the hysteresis voltage in a voltage comparator circuit. Include the relevant resistor values and explain how hysteresis affects the comparator's behavior.[5+5]

OR

7.a) Describe the fundamental operating principles of sampling gates in digital systems. What is their role in data acquisition and signal processing?

b) Draw and explain four diode sampling gate circuit. [5+5]

8.a) Describe the function of a monostable multivibrator in digital circuits. How does it generate a single output pulse in response to a triggering input?

b) Describe how a transistor bootstrap time base generator operates. What are its advantages over other methods? [5+5]

OR

9.a) Discuss the concept of a transistor current time base generator. How does it generate time base signals, and what are its applications?

b) Provide the mathematical equation that defines the duration of the output pulse in a monostable multivibrator. [5+5]

10.a) Discuss the principle of frequency division in a sweep circuit. How does it work, and what types of waveforms can be generated using this technique?

b) In a monostable relaxation circuit, the resistor (R) is 2.2 kΩ, and the capacitor (C) is 22 μF. Calculate the output pulse width when triggered. [6+4]

OR

11.a) A sweep circuit generates a linearly increasing voltage from 0V to 10V in 1 second. Calculate the slope (rate of change) of the voltage with respect to time. If this voltage is applied to a frequency divider circuit, calculate the frequency of the divided output if the division factor is 5.

b) Derive the equation that defines the synchronization frequency in a relaxation oscillator. Assume you have a relaxation oscillator with a resistor of 10 kΩ and a capacitor of 100 μF. Calculate the synchronization frequency. [5+5]

---ooOoo---