Code No: R1631024 | **R16** | SET - 1

III B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019

PULSE AND DIGITAL CIRCUITS

(Electrical and Electronics Engineering)

Time: 3 hours | Max. Marks: 70

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

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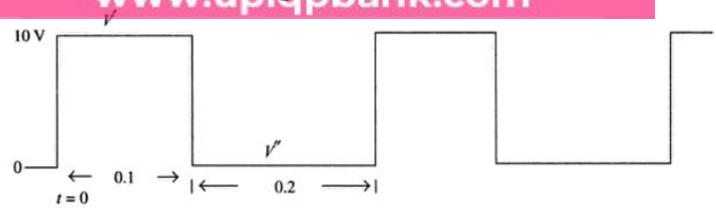
PART –A (14 Marks)

1. a) List any three applications of RLC ringing circuit. [2M]
   b) Draw the circuit diagram for the transfer characteristic shown below. [2M]

   c) Draw the circuit diagram of a Schmitt trigger. [2M]
   d) Define stable state and Quasi Stable State and write the expression for the Quasi stable state duration of Monostable Multivibrator. [3M]
   e) Explain how an ideal voltage sweep waveform can be generated using a simple RC Circuit? [3M]
   f) Define propagation delay, Fan-in and Fan-out of logic circuit. [2M]

PART –B (56 Marks)

2. a) Show that the RC high pass circuit acts as a differentiator. [7M]
   b) A periodic waveform is applied to an RC low-pass circuit shown below is a square wave with T_1=0.1 sec, T_2=0.2 sec and the time constant τ =0.1 sec. Draw the output waveform and mark all voltages. [7M]



3. a) Explain the operation of two level emitter coupled transistor clipper. [7M]
   b) Design a diode clamper to restore the negative peaks of the input signal to zero level. Use a silicon diode with R_f = 50 Ω and R_r = 400 kΩ. The frequency of the input signal is 5kHz. [7M]

4. a) Explain the saturation parameters of Transistor and their variation with temperature. [7M]
   b) A self-bias bistable multivibrator uses Si transistors having h_{FE}(min) = 50, V_{CC} = 18 V, R_1 = R_2, $I_{C(sat)}$ = 5 mA. Find the component values R_E, R_C, R_1 and R_2. [7M]

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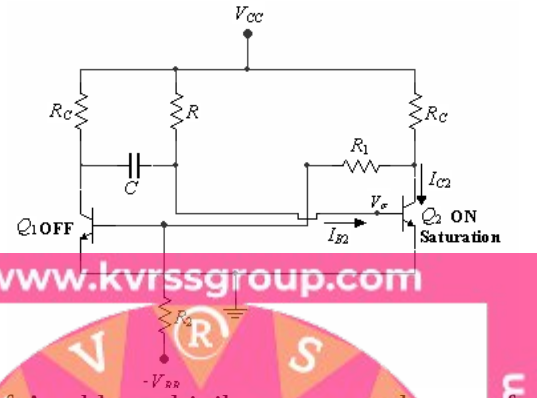
5. a) Design a collector–coupled monostable multivibrator shown in below figure, to obtain output pulse of amplitude 10V. Given that $I_C(sat)$=10mA, $I_{B2}=2I_{B2(min)}$, $V_{CE}(sat)$=0.1V, $V_{BE}(sat)$=0.3V, $h_{FE(min)}$=40 and a pulse of duration 1000μsec is required, $V_{BE}(cut\text{-}off)$= -1V. [7M]



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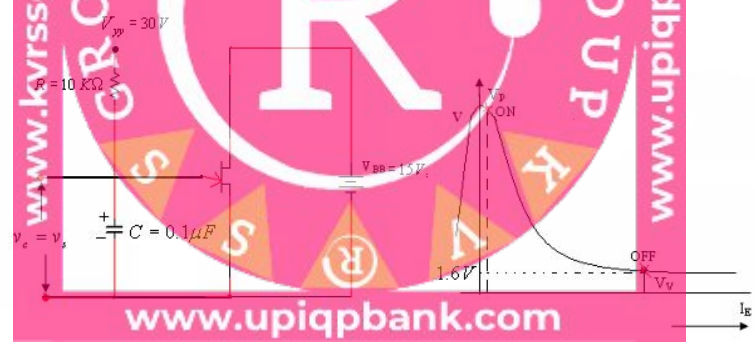
b) Explain the operation of Astable multivibrator as a voltage to frequency converter and derive the expression for time period of it. [7M]

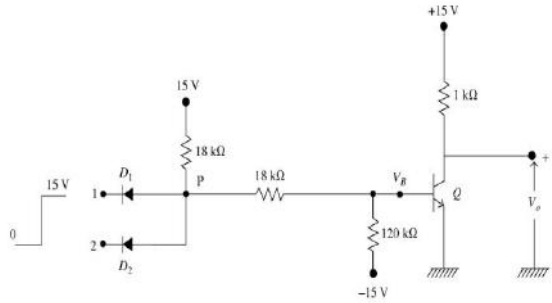
6. a) The UJT relaxation oscillator and UJT characteristics are shown below. Find the values of i) Sweep signal amplitude ii) The slope and displacement errors and iii) The time of the sweep. [7M]



b) List any three errors of generation in sweep waveform. Show the sweep speed error of exponential sweep circuit is $\frac{T_S}{\tau}$. [7M]

7. a) Why pedestal is seen in the output of a sampling gate and explain how it can be reduced? [7M]

b) Justify that the Logic shown below is a DTL NAND gate. [7M]



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Code No: R1631024 **R16** SET - 2

III B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019

PULSE AND DIGITAL CIRCUITS

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

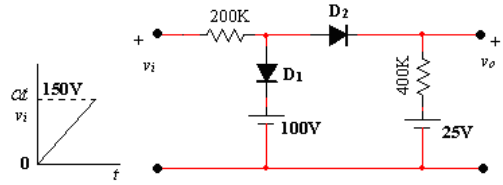
1. a) What is meant by linear wave shaping? [2M]
   b) Draw the transfer characteristic of the circuit shown below. [2M]

   c) Draw the V-I Characteristics of a practical diode and ideal diode. [2M]
   d) What you understand by the term noise immunity? [3M]
   e) What is the role of Commutating Capacitors in multivibrators? [3M]
   f) List any three applications of Time base generators. [2M]

PART –B (56 Marks)

2. a) A square wave whose peak to peak amplitude is 4 V extends ±2 V with respect to ground. The duration of the positive section is 0.3 sec and that of the negative section is 0.1 sec. If this waveform is impressed upon an RC differentiating network whose time constant is 0.3 sec, what are the steady state maximum and minimum values of the output waveform? [7M]
   b) Sketch the response of the low pass RC circuit for a step input with different time constants and derive the expression for rise time. [7M]

3. a) For the two-level clipper shown, the input varies linearly from 0 to 150 V. Plot the transfer characteristics and obtain the output voltage. Assume the diodes are ideal. [7M]



   b) State and prove clamping circuit theorem. [7M]

4. a) Define the following switching times of transistor: [7M]
   Rise time, Fall time, Storage time, Turn off tine and Delay time.
   b) Design a fixed-bias bistable multivibrator using Ge transistors having $h_{FE(min)} = 50$, $V_{CC} = 10$ V and $V_{BB} = 10$ V, $V_{CE(sat)} = 0.1$ V, $V_{BE(sat)} = 0.3$ V, $I_{C(sat)} = 5$ mA and assume $I_{B(sat)} = 1.5I_{B(min)}$. [7M]

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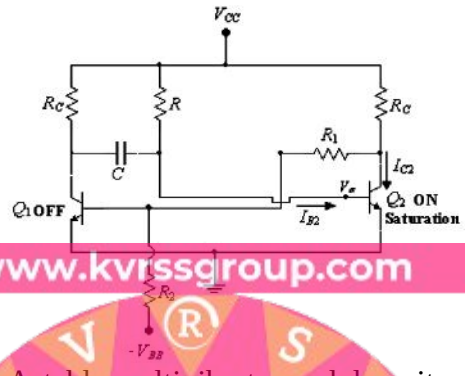
5. a) For a collector-coupled monostable multivibrator circuit shown R_1= R_2=R=10 kΩ, C = 0.01 μF, R_C= 1 kΩ, V_{CC}= 10 V, h_{FE}= 20. In the quasi-stable state, Q_1 is in the active region with collector current of 2 mA. Find the time period and the value of V_{BB}. Neglect junction voltages. $I_{B\,(sat)} = 1.5I_{B\,(min)}$. [7M]



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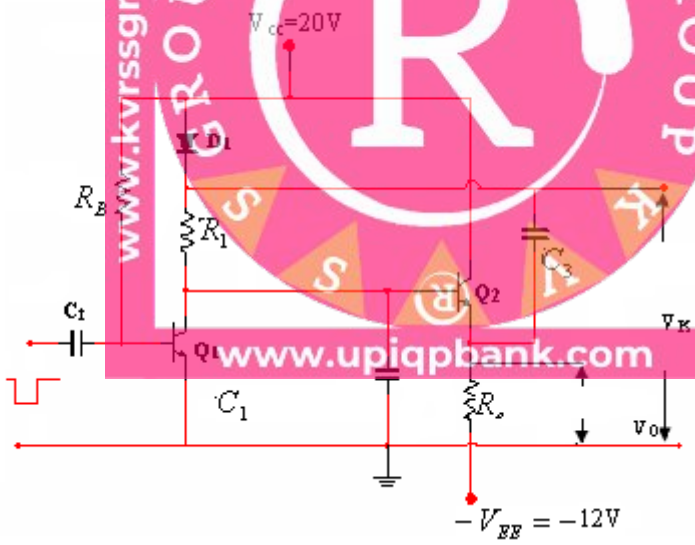
b) Explain the operation of Astable multivibrator and draw its output waveforms. [7M]

6. a) Determine the values of R_e, R_B, C_1 and C_3 of bootstrap circuit shown below if I_{C1}=1.5mA, I_{E2}=1.75mA $h_{FE(min)}$=30, $V_{CE(sat)}$=0.3V, $V_{BE(sat)}$=0.7V and $V_{BE(active)}$=0.6V [7M]



b) Draw the circuit of a miller integrator and explain how it improves the linearity of the sweep waveform? [7M]

7. a) Explain the operation of Unidirectional sampling gate and list any two advantages and disadvantages. [7M]

b) What is the major difference between TTL and ECL? Why does the propagation delay occur in logic circuits? Explain. [7M]

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2. Answer **ALL** the question in **Part-A**
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PART –A (14 Marks)

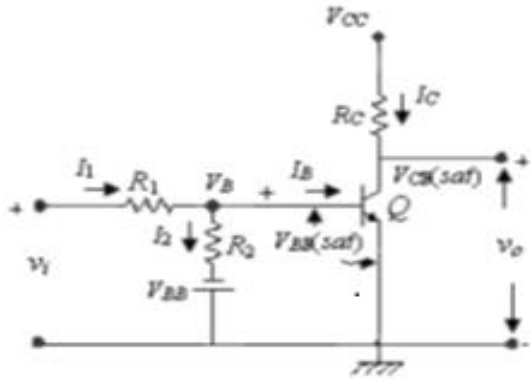
1. a) Draw the circuit diagram of a multivibrator which can be used as a flip flop. [2M]
   b) The collector-coupled monostable multivibrator using an n-p-n silicon transistor with $h_{FE(min)} = 40$, $V_{BE\ (cut\ off)} \approx 0$ V and $I_{B(sat)} = 1.5I_{B(min)}$. Given that: VCC = 10 V, $I_{C(sat)} = 5$ mA, $R_{C1} = R_{C2} = R_C$, $V_{CE(sat)} = 0.2$ V and $V_{BE(sat)} = 0.7$ V. Calculate the value of R_C. [3M]
   c) List any three applications of time base generators. [2M]
   d) Draw the output waveform of RC high pass circuit for three different time constants when it is excited by step input. [3M]
   e) List any three advantages and two disadvantages of a unidirectional sampling gate. [2M]
   f) State Clamping circuit theorem. [2M]

PART –B (56 Marks)

2. a) What is an attenuator? How can an uncompensated attenuator modified as a compensated attenuator. Give the comparison between perfect compensation, under compensation and over compensation. [7M]
   b) A square wave whose peak to peak amplitude is 4 V extends ±2 V with respect to ground. The duration of the positive section is 0.1 sec and that of the negative section is 0.3 sec. If this waveform is impressed upon an RC integrating network whose time constant is 0.3 sec, what are the steady state maximum and minimum values of the output waveform? [7M]

3. a) A symmetrical 50 Hz square wave whose peak to peak excursions are ± 100 V with respect to ground is to be negatively clamped at 25 V. Draw the necessary circuit diagram and output waveform for this purpose . [7M]
   b) Explain the operation of practical clamper circuit for varying input amplitude. [7M]

4. a) For the transistor switch shown below, If V_{CC}=12 V and V_{BB}=-5V,$I_{C(sat)}$=4mA and h_{FE}=50, the input signal changes from 0 to 12 V. Design the transistor switch. [7M]



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b) Design a Schmitt trigger circuit for the following specifications: UTP = 8 V, LTP = 5 V, V_{CC} = 15V, I_C (sat) = 2 mA, h_{FE}(min) = 25. [7M]

5. a) Calculate the component values of a monostable multivibrator developing an output pulse of 500 μs duration. Assume $h_{FE(min)}$ = 25, $I_{CE(sat)}$ = 5 mA, V_{CC} = 10V and V_{BB} = -4V. [7M]

b) Explain the operation of Astable multivibrator and derive the expression for frequency of oscillation. [7M]

6. a) Show that $e_d = \frac{1}{8} e_s = \frac{1}{4} e_t$ for an exponential sweep generator. Where e_d = Displacement error e_s =Sweep Speed error, e_t =Transmission error. [7M]

b) Explain how UJT can be used to generate a sweep waveform? [7M]

7. a) Explain the operation of a Four diode Sampling Gate and explain its operation. Derive the expression for $V_{C(min)}$ and Gain. [7M]

b) What is the main advantage of the totem pole arrangement and explain the working TTL totem pole NAND gate. [7M]

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) Define storage time and rise time of a transistor. [2M]
   b) Draw the V-I characteristic of UJT and indicate the region in which it can be used as a sweep generator [2M]
   c) A monostable multivibrator is used as a voltage-to-time converter. Find the time period if R = 10 kΩ , C = 0.01 μF, $\frac{V_{BB}}{V_{CC}} = 0.5$. [2M]
   d) Explain how a clamper can be used as a comparator. [3M]
   e) Explain the application of an attenuator in CRO. [3M]
   f) Write any two differences between logic gate and sampling gate. [2M]

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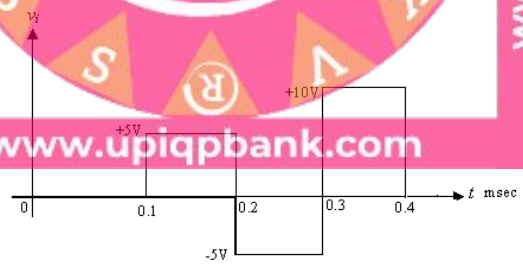
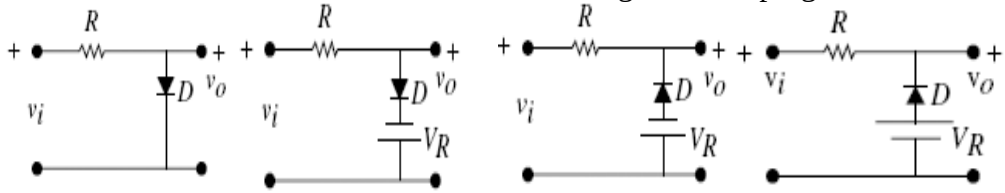
PART –B (56 Marks)

2. a) Prove that a low pass circuit acts as an Integrator. [7M]
   b) The input signal shown in Fig. below is applied to a RC high-pass circuit, whose time constant is 0.4*ms*. Draw the output waveform and mark all voltages, assuming that the capacitor is initially uncharged. [7M]



3. a) Explain the operation of a positive clamper for sinusoidal input. [7M]
   b) Draw the transfer characteristics of the following wave shaping circuits. [7M]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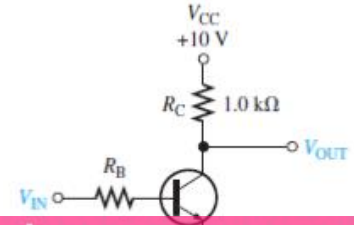
4. a) For the transistor circuit shown below what is V_{CE} when V_{IN} = 0 V? What minimum value of I_B is required to saturate this transistor if β_{DC} is 200? Neglect $V_{CE(sat)}$. Calculate the maximum value of R_B when V_{IN} = 5 V. [7M]



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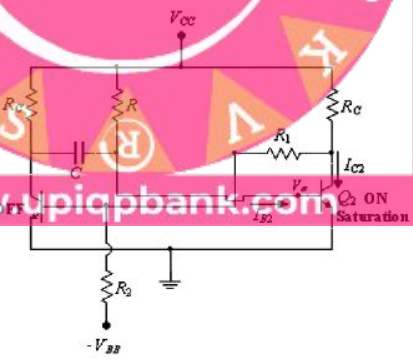
b) Explain the operation of a Schmitt Trigger and derive the expressions for UTP and LTP. [7M]

5. a) Explain the operation of astable multivibrator and derive the expression for the frequency of oscillation. [7M]

b) The 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. [7M]



6. a) Explain how Miller Integrator sweep generator improves the linearity? [7M]

b) Explain the operation of a transistor based bootstrap sweep generator and derive the expression for Sweep time. [7M]

7. a) Compare the performance of RTL, DTL and TTL families. [7M]

b) List any three applications of sampling gates and explain any one of them in detail. [7M]

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