

**III B.Tech. I Semester Supplementary Examinations, May -2005**  
**DIGITAL ELECTRONICS**  
**(Mechatronics)**

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

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1. Draw the circuit diagram of Emitter coupled clipping circuit and draw its transfer characteristics. Explain the operation of circuit and derive the expression for total output voltage swing.
2. (a) Explain the Operation of an Astable multivibrator and Derive expressions for period of oscillation.  
(b) Find the pulse width and period of output of an Astable multivibrator where  $R_1=R_2=30\text{K}\Omega$ ,  $C_1=C_2=0.2\text{ }\mu\text{F}$  and take necessary assumptions.
3. (a) Explain the operation of a Sweep circuit using Transistor as a Switch.  
(b) A bootstrap sweep generator has the following specifications.  $V_{CC} = 20\text{ V}$ ,  $V_{EE} = -10\text{V}$ ,  $R_B = 200\text{ K}\Omega$ ,  $R_{C1} = 20\text{ K}\Omega$ ,  $C_S = 0.015\text{ }\mu\text{F}$ ,  $R_e = 11\text{ K}\Omega$ ,  $T_g = 0.6\text{ m sec}$ ,  $C_B = 0.2\text{ }\mu\text{F}$ . The transistor Q1 and Q2 are silicon with  $V_{CE(sat)} = 0.3\text{ V}$ ,  $V_{BE(sat)} = 0.7\text{V}$ ,  $h_{FE(min)} = 35$ . Assume a forward voltage drop of 0.5 V across diode D.
  - i. Show all the quiescent state currents and voltages in the circuit and calculate them.
  - ii. Determine the sweep time and sweep frequency.
4. (a) What are self complementing codes and explain them with examples.  
(b) Mention and explain basic theorems and properties of Boolean algebra?
5. (a) Implement a Full Adder with two 4x1 Multiplexers  
(b) Construct a 16x1 Multiplexer with two 8x1 Multiplexers and one 2x1 Multiplexer.
6. (a) Why preset and clear inputs are required by a FF. Explain the operation of a clocked RS-FF with preset and clear inputs with the help of complete truth table and output waveforms?  
(b) What is the basic sequential circuit that stores 1-bit of memory. Draw its diagram and truth table. mention some applications of it?
7. (a) Explain propagation delay associated with ripple counters.  
(b) What is modulus related to counters. Draw and explain the operation of a MOD-8 counter with the help of timing diagrams?
8. (a) Distinguish between LED and LCD displays.

(b) Explain why driver circuits are needed with reference to LED displays.

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1. (a) Show that for any periodic input waveform average level of the steady state output signal from the RC high pass circuit is always zero.  
(b) Define the  $e_t$  (transmission error) in the case of RC high pass circuit and if we apply a Ramp signal  $V_i = \alpha t$  for a period of time T what should be the  $e_t$ .
2. (a) Explain the Operation of an Astable multivibrator and Derive expressions for period of oscillation.  
(b) Find the pulse width and period of output of an Astable multivibrator where  $R_1 = R_2 = 30K\Omega$ ,  $C_1 = C_2 = 0.2 \mu F$  and take necessary assumptions.
3. (a) Explain the operation of bootstrap sweep circuit, why it is termed as bootstrap and derive the expression for the sweep error.  
(b) Design a Schmitt trigger circuit for the following specifications.  
 $UTP = 6V$ ,  $LTP = 4 V$ ,  $V_{CC} = 12 V$ ,  $i_{c(max)} = 1 \text{ mA}$  and  $h_{FE(min)} = 30$ .
4. Convert the following decimal numbers to the bases indicated. Mention the procedure.
  - (a) 7562.45 to octal
  - (b) 1938.257 to hexadecimal
  - (c) 175.75 to binary
  - (d) 56.25 to binary
5. (a) Implement a Full Adder with two 4x1 Multiplexers  
(b) Construct a 16x1 Multiplexer with two 8x1 Multiplexers and one 2x1 Multiplexer.
6. (a) What is the difference between a combinational circuit and a sequential circuit? Give some examples and applications of both?  
(b) Draw and explain a clocked RS-FF with the help of truth table and output waveforms?
7. (a) Explain propagation delay associated with ripple counters.  
(b) What is modulus related to counters. Draw and explain the operation of a MOD-8 counter with the help of timing diagrams?
8. (a) Distinguish between LED and LCD displays.

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1. Explain the response of RC high pass circuit to a symmetrical square wave input and derive the expression for the % tilt.
2. (a) Explain the Operation of an Astable multivibrator and Derive expressions for period of oscillation.  
(b) Find the pulse width and period of output of an Astable multivibrator where  $R_1=R_2=30K\Omega$ ,  $C_1=C_2=0.2 \mu F$  and take necessary assumptions.
3. (a) Explain the hysteresis loss in the Schmitt trigger and how it can be eliminated.  
(b) Design a sweep circuit  $R_{b1} = R_{b2} = 0$ . The sweep amplitude is to be 12 V. The sweep transition is 2 m sec and sweep speed error is 15%. Specify reasonable values for  $V_{BB}$ ,  $V_{\gamma\gamma}$ , R and C.
4. Add and multiply the following numbers without converting to decimal
  - (a) Octal - 367 and 715
  - (b) Hexadecimal - 15F and A7
  - (c) Binary -1101 and 1101
  - (d) Binary- 0011 and 1000
5. (a) Implement the following function with an 8x1 MUX  
 $F(A,B,C,D)=\Sigma(0,1,3,4,8,9,15)$   
(b) Implement a Full Adder with NAND gates only. Derive expressions for Sum and Carry from the truth table?
6. (a) What is the difference between a combinational circuit and a sequential circuit? Give some examples and applications of both?  
(b) Draw and explain a clocked RS-FF with the help of truth table and output waveforms?
7. (a) Give the difference between synchronous and asynchronous counters.  
(b) Draw and design a 3-bit synchronous counter using JK-FFs with the help of K-maps. also give timing diagrams?
8. (a) Why LCDs are preferred to LEDs. Explain the importance of LCD displays in calculators.  
(b) Explain the BCD to 7 segment decoder driver.

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1. Explain the response of RC high pass circuit to a symmetrical square wave input and derive the expression for the % tilt.
2. (a) Design an Astable circuit for output amplitude of 15V and square wave frequency of 500Hz. Assume  $h_{FE(min)} = 50$ ,  $I_{C(sat)} = 5\text{mA}$ ,  $V_{CE(sat)} = 0\text{V}$ .  
(b) Design a Collector coupled monostable multivibrator using npn Si transistors to produce a pulse of  $200\ \mu\text{sec}$  width and of amplitude 10V. Assume:  
 $I_{C(sat)} = 10\text{mA}$ ,  $V_{BE(cutoff)} = -1\text{V}$ ,  $BV_{EBO} = 6\text{V}$ ,  $V_{CE(sat)} = 0.3\text{V}$ ,  $V_{BE(sat)} = 0.7\text{V}$ , and  $h_{FE(min)} = 30$ . Show the circuit diagram with all the component values.
3. (a) Explain the operation of bootstrap sweep circuit, why it is termed as bootstrap and derive the expression for the sweep error.  
(b) Design a Schmitt trigger circuit for the following specifications.  
 $UTP = 6\text{V}$ ,  $LTP = 4\text{V}$ ,  $V_{CC} = 12\text{V}$ ,  $i_{c(max)} = 1\text{mA}$  and  $h_{FE(min)} = 30$ .
4. Add and multiply the following numbers without converting to decimal
  - (a) Octal - 367 and 715
  - (b) Hexadecimal - 15F and A7
  - (c) Binary -1101 and 1101
  - (d) Binary- 0011 and 1000
5. (a) Implement a Full Subtractor with NOR gates only. Give the expressions for Difference and Borrow with the help of truth table?  
(b) Design a combinational circuit that gives sum of two 2-bit numbers  $x_1x_0$  and  $y_1y_0$  whose outputs are Carry, Sum1, Sum0 by using two Full Adders. Also derive expressions for outputs from truth table?
6. (a) What is the difference between a combinational circuit and a sequential circuit? Give some examples and applications of both?  
(b) Draw and explain a clocked RS-FF with the help of truth table and output waveforms?
7. (a) Give the difference between synchronous and asynchronous counters.  
(b) Draw and design a 3-bit synchronous counter using JK-FFs with the help of K-maps. also give timing diagrams?

8. (a) Distinguish between LED and LCD displays.
- (b) Explain why driver circuits are needed with reference to LED displays.

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