

7. (a) Give the difference between synchronous and asynchronous counters. [6]
(b) Draw and design a 3-bit synchronous counter using JK-FFs with the help of K-maps. also give timing diagrams? [10]
8. (a) Why LCDs are preferred to LEDs. Explain the importance of LCD displays in calculators. [8]
(b) Explain the BCD to 7 segment decoder driver. [8]

III B.Tech. I Semester Regular Examinations, November -2005
DIGITAL ELECTRONICS
(Mechatronics)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Classify the clippers and analyze the clipping operation with a neat circuit diagram. [8]
 (b) What is Clamping circuit theorem and prove that $A_f / A_R = R_f / R$. [8]
2. (a) Design an Astable circuit for output amplitude of 15V and square wave frequency of 500Hz. Assume $h_{FE(min)} = 50$, $I_{C(sat)} = 5\text{mA}$, $V_{CE(sat)} = 0\text{V}$. [8]
 (b) Design a Collector coupled monostable multivibrator using npn Si transistors to produce a pulse of 200 μ 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. [8]
3. (a) Define the following terms.
 i. Rise time
 ii. Fall time
 iii. Turn on time
 iv. Turnoff time. [8]
 (b) A Schmitt trigger has the following circuit components $R_1 = R_2 = 20\text{K}\Omega$, $R_{C1} = R_{C2} = 5\text{K}\Omega$ and $R_e = 2\text{K}\Omega$. The supply voltage is 15 V. For the npn Si transistors used, $h_{fe} = 100$. Find UTP and LTP. [8]
4. Explain the properties of EX-OR gates and prove the following [16]
 (a) If $A \oplus B = 0$ then $A=B$.
 (b) if $A \oplus C = B \oplus C$ then $A=B$
 (c) $A \oplus B = A' \oplus B'$.
5. (a) Implement the following function with an 8x1 MUX [8]
 $F(A,B,C,D) = \Sigma(0,1,3,4,8,9,15)$
 (b) Implement a Full Adder with NAND gates only. Derive expressions for Sum and Carry from the truth table? [8]
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? [8]

- (b) What is the basic sequential circuit that stores 1-bit of memory. Draw its diagram and truth table. mention some applications of it? [8]
- 7. (a) Explain propagation delay associated with ripple counters. [6]
- (b) What is modulus related to counters. Draw and explain the operation of a MOD-8 counter with the help of timing diagrams? [10]
- 8. (a) Why LCDs are preferred to LEDs. Explain the importance of LCD displays in calculators. [8]
- (b) Explain the BCD to 7 segment decoder driver. [8]

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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. [16]
2. (a) For the fixed bias Germanium transistor npn type, the junction voltages at saturation cutoff and in active region may be assumed to be zero. This circuit operates properly over the temperature range -50°C to $+75^{\circ}\text{C}$ and it just starts mal functioning at these extremes. The various circuit specifications are $V_{CC} = 4.5\text{ V}$, $V_{BB} = 3.0\text{ V}$, $h_{fe} = 40$ at -50°C , $h_{fe} = 60$ at 75°C , $I_{CBO} = 4\mu\text{A}$ at 25°C and doubles for every 10°C . Collector current is 10mA . Design the values of R_{C1} , R_1 and R_2 . [8]
- (b) Explain the Operation of Bistable multivibrator and derive the stable state currents and voltage expressions. [8]
3. (a) What is meant by Schmitt trigger explain one application of Schmitt trigger. [8]
- (b) Design a relaxation oscillator to have 3 KHz output frequency using $2\text{N}3980$ and a 20 V supply. Calculate the output amplitude. Specifications given are $\eta = 0.68$ to 0.82 , $I_P = 2\mu\text{A}$, $I_v = 1\text{ mA}$ and $V_{EB(sat)} = 3\text{ V}$. [8]
4. Prove the following EX-OR operations
 - (a) If $A \oplus B = B \oplus A$ [4]
 - (b) if $(A \oplus B) \oplus C = A \oplus (B \oplus C) = A \oplus B \oplus C$ [4]
 - (c) $(AB) \oplus (AC) = A(B \oplus C)$ [4]
 - (d) if $A \oplus B = C$ then $A \oplus C = B, B \oplus C = A, A \oplus B \oplus C = 0$ [4]
5. (a) Implement a Full Subtractor with NOR gates only. Give the expressions for Difference and Borrow with the help of truth table? [8]
- (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? [8]
6. (a) What is the difference between a combinational circuit and a sequential circuit? Give some examples and applications of both? [8]
- (b) Draw and explain a clocked RS-FF with the help of truth table and output waveforms? [8]

7. (a) Explain propagation delay associated with ripple counters. [6]
(b) What is modulus related to counters. Draw and explain the operation of a MOD-8 counter with the help of timing diagrams? [10]
8. (a) Distinguish between LED and LCD displays. [10]
(b) Explain why driver circuits are needed with reference to LED displays. [6]

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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. [16]
2. (a) Explain the Operation of an Astable multivibrator and Derive expressions for period of oscillation. [8]
(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. [8]
3. (a) Explain how transistor will act as a switch and explain the switching characteristics of a transistor. [8]
(b) Draw the characteristics of CE configuration and explain how $V_{CE(sat)}$ varies with respect to different load resistances. [8]
4. The binary numbers listed below have a sign in the leftmost position and if negative, are in the 2's complement form. Perform the arithmetic operations involved and verify the answers.
 - (a) $101011 + 111000$ [4]
 - (b) $001110 + 110010$ [4]
 - (c) $111001 - 001010$ [4]
 - (d) $101011 - 100110$ [4]
5. (a) Implement a Full Subtractor with NOR gates only. Give the expressions for Difference and Borrow with the help of truth table? [8]
(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? [8]
6. Discuss edge-triggering D-FF with truth table and timing diagrams? Explain how a SR-FF is implemented into a D-FF with truth tables? [16]
7. (a) Draw and explain 4-bit left shift and right shift registers with timing diagrams? [8]
(b) What is a counter? Give some applications. What is the difference between synchronous and asynchronous counters? Draw and explain the operation of a 4-bit synchronous counter with its truth table and waveforms? [8]

8. (a) Distinguish between common anode and common cathode type of 7-segment displays. [8]
- (b) Explain the seven-segment decoder driving circuit. [8]

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