

**III B.Tech I Semester Regular Examinations, November 2006**  
**DIGITAL ELECTRONICS**  
(Mechatronics)

**Time: 3 hours**

**Max Marks: 80**

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

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1. (a) Explain the response of low pass RC circuit for square wave input. [8]  
(b) Explain the Operation of Zener diode clippers with relevant circuit diagrams. [8]
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. Add and multiply the following numbers without converting to decimal [16]
  - (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 NAND gates only. Give the expressions for Difference and Borrow with the help of truth table? [8]  
(b) Implement the following function with an  $8 \times$  MUX [8]  
 $F(A,B,C,D)=\Sigma(0,1,3,4,8,9,15)$
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) 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) 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) How the linearity can be improved in Sweep circuits. [6]  
(b) Define rise time and fall time of Transistor Switch. Derive expressions for these in terms of transistor parameters and operating currents. [10]
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 Adder with two 4x1 Multiplexers [8]  
(b) Construct a 16x1 Multiplexer with two 8x1 Multiplexers and one 2x1 Multiplexer. [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) 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. Explain the response of RC high pass circuit to a symmetrical square wave input and derive the expression for the % tilt. [16]
2. (a) Design an Astable circuit for output amplitude of 15V and square wave frequency of 500Hz. Assume  $h_{FE(min)} = 50$ ,  $I_{C(sat)} = 5mA$ ,  $V_{CE(sat)} = 0V$ . [8]  
 (b) Design a Collector coupled monostable multivibrator using npn Si transistors to produce a pulse of  $200 \mu$  sec width and of amplitude 10V. Assume:  $I_{C(sat)} = 10mA$ ,  $V_{BE(cutoff)} = -1V$ ,  $BV_{EBO} = 6V$ ,  $V_{CE(sat)} = 0.3V$ ,  $V_{BE(sat)} = 0.7V$ , and  $h_{FE(min)} = 30$ . Show the circuit diagram with all the component values. [8]
3. (a) How the linearity can be improved in Sweep circuits. [6]  
 (b) Define rise time and fall time of Transistor Switch. Derive expressions for these in terms of transistor parameters and operating currents. [10]
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 a Full Adder with two 4x1 Multiplexers [8]  
 (b) Construct a 16x1 Multiplexer with two 8x1 Multiplexers and one 2x1 Multiplexer. [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 in detail a 4-bit up/down counter with timing diagrams? [8]  
 (b) What are the four different possible configurations of shift registers? Draw a general 4-bit shift register and its timing diagrams? [8]
8. (a) Explain briefly the 4 to 10 line decoder. [8]  
 (b) Explain the seven-segment decoder driving circuit. [8]

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1. (a) Prove mathematically that voltage across a capacitor cannot become zero instantaneously. [8]  
(b) What are the applications of a differentiator and explain the response of typical differentiator for an input square wave. [8]
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) Derive the expressions for UTP and LTP in Schmitt trigger by taking necessary assumptions. [8]  
(b) Design a Schmitt trigger circuit using npn transistors having  $h_{FE(min)} = 60$ ,  $V_{BE\ cut-off}=0V$ ,  $V_{CE(sat)} = 0.2V$ ,  $V_{BE(sat)} = 0.7V$ . Given  $V_{CC} = 18 V$  and output swing 6V. UTP = 3.5V, LTP = 1.5V,  $R_1 = 10 K\Omega$ ,  $R_2 = 2 K\Omega$ . Determine  $R_{C1}$ ,  $R_{C2}$  and  $R_e$ . [8]
4. Add and multiply the following numbers without converting to decimal [16]  
(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 Adder with two 4x1 Multiplexers [8]  
(b) Construct a 16x1 Multiplexer with two 8x1 Multiplexers and one 2x1 Multiplexer. [8]
6. (a) Discuss briefly about any four applications of flip-flops? [6]  
(b) What is the difference between a latch and a Flip Flop? Draw the diagram of JK-FF its truth table and timing diagrams? [10]
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 LED and LCD displays. [10]  
(b) Explain why driver circuits are needed with reference to LED displays. [6]

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