14) a) Convert $(9\ AB)_{16}$ to $(\ )_2, (\ )_8\ (\ )_{10}$. **5**

   b) Subtract $(29)_{10} - (7)_{10}$ using 2's complement. **5**

15) a) State and prove Demorgan's Law. **5**

   b) Simplify using K-Map **5**

   $F = \sum m\ (1, 5, 7, 8, 9, 13) + \sum d\ (3, 12)$.

16) a) What is rectifier ? Explain half-wave rectifier. **5**

   b) Differentiate encoder and decoder. **5**

17) a) Realize the basic gates using NAND Gate. **5**

   b) Explain Half adder with truth table and logic circuit. **5**

18) a) What is multiplexer ? Explain 4-to-1 multiplexer. **5**

   b) Explain the working of SR flip flop. **5**

19) a) Explain different energy Bands. **5**

   b) Differentiate forward biasing and reverse biasing. **5**

20) a) Explain SISO and PIPO shift register. **5**

   b) Write a brief note on applications of shift register. **5**