N.B.

1. **Q.1** is compulsory. Attempt **any three** from the remaining questions.
2. All questions carry equal marks.
3. Figures to the Right indicate full marks.
3. Assume suitable data if necessary

Q.1 Attempt **any four**   20

a. What are priority encoders? Explain their usage in detail.

b. Perform subtraction using 2's complement :

   (i) $23 - 48$ (ii) $32 - 64$.

c. Convert $(110101.10101)_2$ to equivalent decimal and hexadecimal number.

d. Explain Ring counter in detail.

e. Encode the following binary words into 7-bit odd parity Hamming code .
   (i) 1001 (ii) 1101.

f. Write the significance of standard SOP and POS forms of Boolean expressions.
   Convert the Boolean expression $y = (A + B)(B + C)(A + C)$ into standard POS
   form.

Q.2 A. Reduce the following function using Karnaugh Map technique and implement it   10
   using gates :

$$f(A, B, C, D) = \prod M(4, 6, 10, 12, 13, 15)$$

B. Design full adder circuit using half adder circuits.   10

Q.3 A. What do you mean by Multiplexer tree? Construct 32:1 multiplexer using 8:1 mul-   10
   tiplexer.

B. Design parity generator / checker circuits.   10

Q.4 A. What are sequential circuits? Explain D flip-flop in detail.   10
B. Design Modulo-9 ripple counter using T flip-flops.   10

Q.5 A. Implement the following function using 8:1 Multiplexer :   10

$$f(P, Q, R, S) = \sum m(0, 1, 3, 4, 8, 9, 15)$$

B. Explain working of Bi-directional universal shift register.   10

Q.6 Write short notes on the following   20
   a. Random-Access Memory.
   b. FPGA.
   c. Comparison of features of TTL, ECL and CMOS family.
   d. Arithmetic Logic Unit (ALU).