EC101- Basic Electronics & Communication Engineering

SEM- I, B.Tech.

Assignment-2, (A.Y. 2025-26) Max. Marks=30

Note: Answer all questions. Assume suitable missing data, if any.

---

1. Perform the following arithmetic operations on signed binary numbers. If number is negative, then it is present in its 2's complement form. (CO3, 3 Marks)
   (a) 101011 + 111000
   (b) 001110 + 110010
   (c) 111001 – 001010
   (d) 101011 – 100110

2. For the given expressions, minimize the functions using K-Map and draw the logic circuit using: (CO3, 3 Marks)
   (a) NOR gates only: F (a, b, c, d) = $\sum$ m (1, 3, 7, 9, 11) + d (6, 10)
   (b) NAND gates only: F (a, b, c, d) = $\sum$ m (0, 1, 4, 5, 6, 7, 9, 11, 15) + d (10, 14)

3. Derive the expressions for Sum and Carry of full adder and full subtractor. Also, draw its logic diagram. (CO4, 3 Marks)

4. Implement Y = A.B using 2X1 Multiplexer and draw the logic circuit. (CO, 3 Marks)

5. The waveforms shown in Figure 1 are applied to the JK flip flop. Draw the output waveform. (CO, 3 Marks)

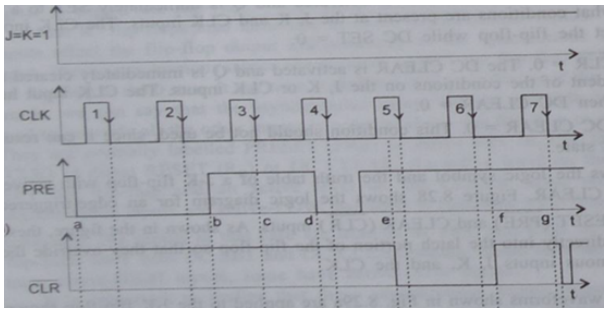

Figure 1: Waveforms

6. A carrier wave $c(t) = 10\ cos2\pi10^6t$ is amplitude modulated by a message signal $m(t) = 4\ cos4\pi10^3t$ with 50% modulation index. Antenna resistance is 50Ω. Determine: (CO4, 3 Marks)

(a) BW for single tone modulation.

(b) Power in the USB,LSB and carrier wave.

(c) Efficiency

(d) Plot the AM spectrum and identify the spectral components.

7. A carrier wave $c(t) = 20\sqrt{2}\ cos2\pi10^5t$ is DSB-SC modulated by a message signal $m(t) = 2\sqrt{2}\ cos\pi10^3t$. Antenna resistance is 1Ω. Determine: (CO4, 3 Marks)

   (a) BW of the signal.

   (b) Total Transmitted Power.

   (c) Efficiency

   (d) Plot the spectral components.

8. A sinusoidal carrier of 20V, 2MHz is transmitted by frequency modulation of the message signal $m(t) = 10\ sin4\pi10^3t$ and $k_f = 50kHz/V$. Determine: (CO4, 3 Marks)

   (a) Δf.

   (b) f_{max} and f_{min}.

   (c) BW

   (d) Plot the spectral components.

9. A message signal $m(t) = 10\ cos8\pi10^3t$ is transmitted through PCM system. Determine: (CO5, 3 Marks)

   (a) Number of quantization levels

   (b) Step size.

   (c) Sampling rate

   (d) Max. quantization error.

   (e) For the same signal, sampling rate is 50% higher than Nquist Rate. The minimum required SNR is 22dB. Find Transmission BW and $SQNR_{dB}$

10. A voice signal is sampled at the rate of 8000 samples/sec and each sample is encoded in to 8 bits using PCM. The binary data is transmitted into free space after modulation. Determine the Bandwidth of modulated signal, if the modulation technique used are: (CO5, 3 Marks)

    (a) ASK

    (b) PSK

    (c) FSK with $f_H = 10MHz$ and $f_L = 8MHz$