

# ADC module 1 Problems

1. The antenna current of AM broadcast txr modulated to the depth of 40% by an audio sine wave is 11A. It increases to 12A as a result of simultaneous modulation by another audio sine wave. What is the modulation index due to this second wave? [Ans:  $m_2 = 0.64$ ]
  
2. An SSB txn contains 10 KW. This txn is to be replaced by a std amplitude modulated s/g with the same power content. Determine the power content of carrier and each of the side bands when % modulation is 80%.  
[Ans:  $P_c = 7.57\text{KW}$   $P_{LSB} = P_{USB} = 1.21\text{KW}$ ]
  
3. A given AM broadcast station transmits a total power of 50KW when the carrier is modulated by a sinusoidal s/g with a mod index of 0.707. calculate
  - i. Carrier power
  - ii. Transmission efficiency
  - iii. Peak amp of carrier assuming the antenna to be represented by a  $(50 + j0)$  ohm load.  
[Ans:  $P_c = 40\text{KW}$ ,  $\eta = 20\%$ ,  $A_c = 2\text{KV}$ ]

4. The rms value of RF voltage ( $E_0$ ) is 100V. After modulation by sinusoidal AF voltage, the rms value of voltage  $E_0$  of RF becomes 110V. Calculate mod index. [Ans:  $m = 0.648$ ]

5. An AM voltage is represented by  $V = 5[1 + 0.6\cos(6280t)]\sin(2\pi * 10^4t)$  volts. Calculate

i. Modulation depth [0.6]

ii.  $f_m$  [1kHz]

iii. Period of carrier wave [100  $\mu s$ ]

iv. Peak instantaneous value of modulated wave. [8V]

v. Rms V of lower side freq component. [1.06V]

vi. The modulated wave is applied across res of 1Kohm, what is power dissipated? [14.75 mW]

6. The eqn of an angle modulated V is  $e = 10\sin(10^8t + 3\sin 10^4t)$  .

i. What form of angle modulation is this?

ii. Calculate carrier & modulating freq  $[f_c = 15.91 \text{ MHz}, f_m = 1.59 \text{ KHz}]$

iii. Mod index  $[3]$

iv. Deviation  $[4.774 \text{ KHz}]$

v. Power dissipated in 100 ohm resistor.  $[0.5 \text{ W}]$

7. In an FM system, modulating freq  $f_m = 1\text{KHz}$ , the modulating voltage  $E_m = 2\text{V}$  and deviation is 6KHz.

i. If modulating Voltage is raised to 4V, what is new deviation?  $[12\text{kHz}]$

ii. If modulating V is further increased to 8V & modulating freq is reduced to 500Hz what will be deviation?  $[24\text{KHz}]$

8. In an FM s/m, a 7KHz baseband s/g modulates 107.6 MHz carrier wave so that freq deviation is 50KHz. Find

- i. Carrier swing in FM s/g and modulation index [100 KHz, 7.143]
- ii. Highest & lowest freq attained by FM s/g. [107.65 MHz, 107.55 MHz]

9. Determine the freq deviation  $\Delta f$  and carrier swing for an FM s/g which has a carrier freq of 100MHz and whose upper freq is 100.007 MHz when modulated by a particular modulating s/g or wave. Also find the lowest freq reached by the FM wave.

[Hint :  $f_H = f_c + \Delta f$  ,  $f_L = f_c - \Delta f$  ] [ans:  $\Delta f = 7\text{KHz}$ , carrier swing=14KHz,  $f_L = 99.99\text{ MHz}$ ]

10. The equation of amplitude wave is given by  $s(t) = 20[1 + 0.8\cos(2\pi \times 10^3 t)] \cos(4\pi \times 10^5 t)$  Find the carrier power, the total sideband power, and the band width of AM wave.  
[ans:  $P_c = 200 \text{ W}$ ,  $P_{SB} = 64 \text{ W}$ ,  $BW = 2 \text{ KHz}$ ]

11. A carrier wave of frequency 100 MHz is frequency modulated by a sinusoidal wave of amplitude 20 V and frequency of 100 kHz. If the frequency sensitivity of the modulator is 25 kHz/V, find the approximate bandwidth of FM signal. [ans: 1.2 MHz] What happens to BW if modulating s/g amp and freq are doubled. ?