CS/B.Tech/ECE/Odd/Sem-5th/EC-501/2015-16

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

EC-501

ANALOG COMMUNICATION

Time Allotted: 3 Hours   Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions.   10×1 = 10

(i) If $X(f)$ be the Fourier Transform of $x(t)$, then the Fourier transform pair of $x(t)e^{j2\pi f_0 t}$ is

   (A) $X(f-f_0)$ (B) $X(f_0 \cdot f)$ (C) $X(f+f_0)$ (D) $X(f_0)$

(ii) A 1 kW carrier is amplitude modulated to 30%. The average sideband power will be

   (A) 30 W   (B) 45 W   (C) 333 W   (D) 450 W

(iii) The following stage in a radio receiver provides the maximum signal selectivity

   (A) R.F. amplifier   (B) I.F. amplifier
   (C) Audio amplifier   (D) Frequency mixer

(iv) The standard IF frequency is

   (A) 400 kHz   (B) 356 kHz   (C) 1 MHz   (D) 455 kHz

(v) In analog TV, the modulation scheme for picture signal employed is

   (A) DSB-SC   (B) SSB   (C) VSB   (D) FM

(vi) A 1 MHz carrier is amplitude modulated by a square wave of fundamental frequency 1000 Hz. Which among the following frequencies will not be present at modulated output?

   (A) 1001 kHz   (B) 999 kHz   (C) 1000 kHz   (D) 1002 kHz

(vii) Theoretical bandwidth of WBFM is

   (A) half of carrier frequency
   (B) twice the baseband signal bandwidth
   (C) zero
   (D) infinity

(viii) The modulating frequency in frequency modulation is increased from 10 kHz to 20 kHz. The practical bandwidth is

   (A) doubled   (B) halved
   (C) increased by 20 kHz   (D) increased tremendously

(ix) Class C power amplifier may be used with minimum distortion if the modulation is

   (A) DSB-SC   (B) VSB-SC   (C) Simple AM   (D) WBFM

(x) Pre-emphasis is required in FM for

   (A) boosting up of high frequency components
   (B) boosting up of low frequency components
   (C) reduction of low frequency components
   (D) reduction of high frequency components

(xi) The PSD of a White Noise is

   (A) $\dfrac{N_0}{2}$ (B) $\left(\dfrac{N_0}{2}\right)^{-1}$ (C) $\dfrac{N_0}{4}$ (D) N_0

(xii) An amplifier generating no noise, should have noise figure of

   (A) 1 dB   (B) 3dB   (C) 0   (D) 1

GROUP B
(Short Answer Type Questions)

Answer any *three* questions.   3×5 = 15

2. (a) Explain briefly, why modulation is needed in communication system.   2
   (b) Draw the spectrum of (i) DSB-SC (ii) SSB signal (iii) VSB.   3

3. Draw the phasor diagram of AM and DSB-SC modulation.   5

4. Show that if the envelope detector output is to follow the envelope at all   5
   times, it is required that

   $$RC \leq \sqrt{(1-\mu^2)}/\omega_{mR}$$

5. What are the differences between TDM and FDM?   5

6. (a) Write Carson's rule to determine FM signal Bandwidth.   1
   (b) Find the bandwidth of commercial FM signal transmission assuming   4
   frequency deviation 75 kHz and modulating signal bandwidth 15 kHz.

7. A modulating signal 10 sin(2 π × 10^3 t) is used to modulate a carrier signal   5
   20 sin(2 π × 10^4 t). Determine the modulation index, frequency of the
   sideband components and their amplitudes, bandwidth of the modulated
   signal.

GROUP C
(Long Answer Type Questions)

Answer any *three* questions.   3×15 = 45

8. (a) What is the bandwidth of AM, DSB-SC and SSB-SC signal?   2
   (b) How can you measure the modulation index from the envelope of an AM   4
   signal? Explain.
   (c) The tuned circuit of the oscillator in a simple AM transmitter employs a 50   4
   µH coil and a 1nF capacitor. If the oscillator output is modulated by audio
   frequencies up to 10 kHz, what is the frequency range occupied by the
   sidebands?
   (d) Explain switching modulator to generate AM signal.   5

9. (a) What is a balanced modulator? Explain it to generate a DSB-SC signal.   1+4
   (b) If a DSB-SC signal is synchronously demodulated using a locally generated   3
   career with a phase error of θ, Determine the expression of the output signal.
   (c) Explain the filter method to generate SSB-SC signal. Compare it with phase   3+2
   shift method.
   (d) Show that in SSB-SC signal power savings is 83.33% with compare to AM.   2

10. (a) Compare between Amplitude modulation and narrow band Frequency   4
    modulation.
    (b) The equation for an FM wave is   5
    $S(t) = 12\sin[6\times10^8 t + 5\sin 1250t]$. Calculate:
    (i) Carrier frequency
    (ii) Modulating frequency
    (iii) Modulation index
    (iv) Frequency deviation
    (v) Power dissipated in 10 Ω.
    (c) Explain FM signal generation, using P.L.L.   6

11. (a) What do you mean by thermal and white noise?   2
    (b) An amplifier operating over the frequency range from 18 MHz to 20 MHz   3
    has a 10 kΩ input resistor. What is the r.m.s noise voltage at the input to this
    amplifier if the ambient temperature is 27°C.
    (c) What is the importance of calculation of "Figure of Merit" of a system?   2+4
    Calculate signal to noise ratio at the output of a synchronous DSB-SC
    demodulator.
    (d) In a TDM system, five signals are sequentially sampled at a rate 8000   4
    samples/sec. Now each signal is encoded by 8 bits. Find resulting bit rate
    and draw the frame structure.

12. Write short notes on any *three* of the following: 3×5
    (a) Ratio Detection Circuit
    (b) Noise in communication system
    (c) Ring Modulator
    (d) Demodulation of FM signal using PLL
    (e) Stereo – AM or FM.