CS/B.TECH/ECE-N/SEM-5/EC-501/2012-13

2012

# ANALOG COMMUNICATION

Time Allotted : 3 Hours   *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :   10 × 1 = 10

    i)   The length of the antenna to transmit a signal must be at least

         a) $\frac{1}{3}$ wavelength   b) $\frac{2}{3}$ wavelength

         c) $\frac{1}{4}$ wavelength   d) $\frac{3}{4}$ wavelength.

    ii) Two sinusoidal signals are simultaneously modulating a carrier, the modulation indices being 0·3 and 0·4. The overall modulation index is

         a)   0·5   b)   0·1

         c)   0·7   d)   0·12.

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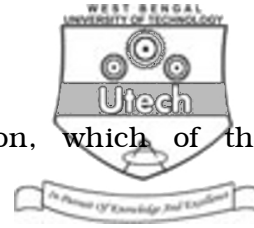
iii) For video transmission of television, which of the following is used ?

a) AM   b) DSB-SC

c) VSB   d) SSB-SC.

iv) A balance modulator circuit is used to reject

a) Carrier   b) LSB

c) USB   d) LSB and USB.

v) The envelope detector is a/an

a) Synchronous detector

b) Asynchronous Detector

c) Product modulator

d) Coherent detector.

vi) When modulating frequency is doubled, the modulation index is halved and the modulating voltage remains constant. The modulation system is

a) AM   b) FM

c) PM   d) any of these.

vii) De-emphasis in FM system involves

    a) Compression of the modulating signal

    b) Expansion of the modulating signal

    c) Amplification of lower frequency signal of modulating signal

    d) Amplification of higher frequency signal of modulating signal.

viii) Armstrong's method is used for the generation of

    a) FM from PM

    b) WBFM from NBFM

    c) PM from FM

    d) All of these.

ix) A PLL can be used to demodulate

    a) PAM signals   b) PCM signals

    c) FM signals   d) DSB-SC signals.

x) The main advantage of TDM over FDM is that it

    a) needs less power

    b) needs less bandwidth

    c) needs simple circuitry

    d) gives better S/N ratio.

xi) The intermediate frequency used for a superheterodyne AM receiver is

a) 455 kHz   b) 755 kHz

c) 545 kHz   d) None of these.

xii) White noise is specified by

a) Gaussian distribution

b) Rician distribution

c) Binomial distribution

d) Maxwell-Boltzman distribution.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. a) What are the basic components of a communication system ?

b) Which of the above components affect the signal most with noise, in a communication system ?

c) Describe why modulation is necessary for communication.   2 + 1 + 2

3. A carrier signal $A_c \cos \omega_c t$ is amplitude modulated by a message signal $A_m \cos \omega_m t$, where $A_m < A_c$.

    a) Write down the expression for the modulated signal.

    b) Write down the expression for carrier component and side band components.

    c) Draw the phasor diagram of the modulated signal.

                                                       2 + 2 + 1

4. Explain briefly the VSB-SC modulation.   5

5. a) What is angle modulation ?

    b) Show that FM and PM are basically same.   2 + 3

6. Explain FM demodulation scheme using PLL. Mention the advantages of PLL demodulator.   4 + 1
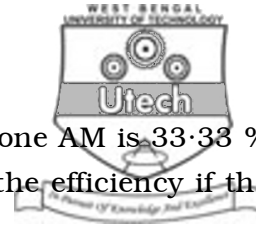
7. Derive the expression for overall noise figure of a cascaded system.   5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

8. a) What do you mean by DSB-SC modulation ? Explain the function of ring modulator in DSB-SC generation.

b) Prove that the efficiency for a single tone AM is 33·33 % for perfect modulation. What will be the efficiency if the value of modulation index is 0·5 ?

c) An AM transmitter has an unmodulated carrier power of 10 kW. It can be modulated by a sinusoidal modulating voltage to a maximum depth of 40%, without overloading. If the maximum modulation index is reduced to 30%, what is the extent up to which the unmodulated carrier power can be increased without overloading ?   (1 + 4) + (3 + 2) + 5

9. a) Compare AM and NBFM.

b) An angle modulated signal is described by the equation $s(t) = 12 \sin [6 \times 10^8 t + 5 \sin 1250 t]$.

Calculate :

(i)   carrier frequency

(ii)   modulating frequency

(iii) modulation index

(iv)   frequency deviation

(v)   power dissipated in 10 Ω resistor.

c) Explain with suitable block diagram the generation of FM signal using Armstrong method.

d) What is Carson's rule ? Explain it.   2 + 5 + 5 + 3

10. a) Explain the terms — 'selectivity', 'sensitivity', and 'fidelity' of a receiver.

b) Draw the block diagram of a superheterodyne receiver and explain the function of each block.
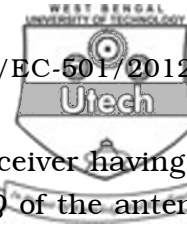
c) For a broadcast superheterodyne AM receiver having no RF amplifier, the loaded quality factor Q of the antenna coupling circuit is 100. Now if the intermediate frequency is 455 kHz, then determine the image frequency and its rejection ratio at an incoming frequency of 1 MHz.   5 + 7 + 3

11. a) What do you mean by thermal and white noise ?

b) An amplifier operating over the frequency range from 18 MHz to 20 MHz 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) Define SNR and Noise Figure. Why is the noise performance of the first stage of a cascade receiver so important ? If each stage of a two-stage cascade amplifier has a gain of 10 dB and noise figure of 10 dB, calculate the total noise figure in dB.

d) Calculate the signal to noise ratio $(S/N)_0$ at the output of a synchronous SSB-SC demodulator.

$$2 + 3 + (3 + 1 + 2) + 4$$

12. Write short notes on any *three* of the following :   3 × 5

a) Pre-emphasis and De-emphasis

b) Foster-Seeley Detector

c) Noise performance in FM system

d) FDM

e) VCO.