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CS/B.TECH(ECE)/SEM-4/EC-403/2011

2011

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 from any *ten* of the following : 10 × 1 = 10

i) The image frequency of a superheterodyne receiver is

a) created within the receiver itself

b) due to sufficient adjacent channel rejection

c) not rejected by IF tuned circuits

d) independent of the frequency to which the receiver is tuned.

ii) The input of the mixer stage is

a) Local oscillator signals only

b) RF signals only

c) Small carrier power

d) Very small carrier power.

iii) A carrier is amplitude modulated by two sine waves of different frequencies up to 40% and 60%. The resulting overall modulation index is

a) 1 b) 0.72

c) 0.4 d) 0.6.

iv) 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 one of them.

v) Which of the following stages has AGC bias ?

a) Local oscillator b) Mixer

c) R. F. amplifier d) A. F. T. discriminator.

vi) A 10 kW transmitter is modulated to 80%. The average sideband power will be

a) 1.8 kW b) 8 kW

c) 3.2 kW d) 4.6 kW.

vii) Varactor diode is used for

a) FM b) PM

c) PULSE Modulation d) AM.

viii) If the radiated power of AM transmitter is 10 kW, the power in the carrier for modulation index of 0.6 is nearly

a) 8.24 kW b) 8.47 kW

c) 9.26 kW d) 9.6 kW.

ix) The envelope detector is a/am

a) Synchronous detector b) Asynchronous detector

c) Product demodulator d) Coherent detector.

x) De-emphasis in FM system involves

a) Compression of 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.

xi) A PAM signal can be detected by using

a) an ADC b) an integrator

c) a bandpass filter d) a highpass Filter.

xii) The modullation system inherently most noise resistant is

a) SSB-SC b) FM

c) PPM d) PCM.

xiii) Entropy is basically a measure of

a) rate of information

b) average information

c) probability of information

d) disorder of information.

xiv) Thermal noise power in a resistor R is proportional to

a) T b) T^2

c) $1/T$ d) T^3 .

xv) Companding is used

a) in PCM transmitter, to allow amplitudes limiting in the receivers

b) to protect small signal in PCM

c) to overcome quantizing noise in PCM

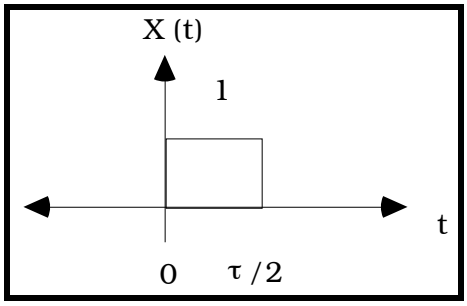
d) in PCM receiver, to overcome impulse noise.

GROUP – B

(Short Answer Type Questions)

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

2. Find the Fourier transform of the following :



3. A modulating signal is given by $V_m = 2 \sin (2\pi \times 500 \, t)$ amplitude modulates a carrier signal given by

$V_c = 10 \sin (2\pi \times 10^6 \, t)$. Determine

i) Modulation index

ii) Frequency present in the modulated signal

iii) Total transmission power.

4. State and prove the Parseval's theorem for power.

5. Explain the direct method of generation of FM signal using a varactor diode. What are the problems of this method ?

3 + 2

6. Compare PAM, PWM and PPM signals.

GROUP – C

(Long Answer Type Questions)

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

7. a) Draw the block diagram of a superheterodyne receiver. Explain the function of each block. 5

   b) Explain the significance of the name superheterodyne. 2

   c) How RF sections suppress the image channel ? 3

   d) Why is up-conversion used in superheterodyne receiver ? 3

   e) Define Image Frequency Rejection Ratio. 2

8. a) "FM and PM are different but inseparable." — Justify the statement. 3

   b) How is a Phase Locked Loop (PLL) used for demodulation of FM signal ? Mention the advantages of PLL demodulator. 5

   c) An angle-modulated signal with carrier frequency $\omega_c = 2\pi \times 10^5$ is described by the equation

   $\varphi FM (t) = 10 \cos (w_c t + 10 \sin 2000 \pi t)$

   i) Find the power of the modulated signal.

   ii) Find the frequency deviation Δf.

   iii) Find the modulation index.

   iv) Estimate the bandwidth required for transmitting this signal. 7

9. a) Explain with suitable block diagram the generation of FM signal using Armstrong method. 5

b) What is Narrowband FM and Wideband FM ? 2

c) Explain with proper expression

i) modulation index for FM

ii) bandwidth required for transmission of FM. 4

d) The maximum deviation allowed in an FM broadcast system is 75 kHz. If the modulating signal is a single tone sinusoid of 10 kHz, find the bandwidth of the FM signal. What will be the change in the bandwidth, if the modulating frequency is doubled ? Determine the bandwidth when modulating signal amplitude is also doubled. 4

10. a) State sampling theorem. What is Nyquist rate of sampling ? 2 + 2

b) What is pulse amplitude modulation ? 2

c) What is meant by flat top sampling ? Why is it more preferred than natural sampling ? 2 + 1

d) Explain the demodulation of PAM signal using a hold circuit. 4

e) What is the bandwidth required for transmission of PAM signal ? 2

11. a) State Channel capacity theorem. 3

b) What is meant by entropy of a source ? 3

c) Apply Shannon-Fano algorithm to the source with M = 8 emitting messages A, B, C, D, E, F, G, H having probabilities P (A) = 1/2, P (B) = 1/8, P (C) = 1/8,

P (D) = 1/16, P (E) = 1/16, P (F) = 1/16, P (G) = 1/32, P (H) = 1/32, calculate entrpy, average code length and efficiency of coding. 9

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

a) Foster Seeley Detector

b) VCO

c) Ring modulator

d) PCM

e) TDM.