KUMARAGURU
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Register Number:……

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Fifth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE110: Communication Theory

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. If the carrier of a 100% modulated AM wave is suppressed, the percentage power saving will be……

   a) 50 b) 100

   c) 150 d) 67

2. A carrier is amplitude modulated simultaneously by two sine waves with modulation indices of 0.3 & 0.6.The effective modulation index is……

   a) 0.9 b) 0.6

   c) 0.7 d) 0.8

3. If the deviation is 75 KHz and maximum modulating frequency is 5 KHz, what is the bandwidth of an FM wave?

   a) 80 KHz b) 320 KHz

   c) 160 KHz d) 40 KHz

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

   a) Amplitude modulation b) Phase modulation

   c) Frequency modulation d) Any one of the three

5. The bandwidth improvement for a receiver with an RF BW equal to 200KHz and an IF BW equal to 10 KHz is…..

   a) 20 b) 13

   c) 10 d) 200

6. A low ratio of the ac to the dc load impedance of a diode detector results in

   a) diagonal clipping b) negative peak clipping

c) poor AGC operation
d) poor AF response

7. Indicate the false statement.
   a) HF mixers are generally noisier than HF amplifiers.
   b) Thermal noise is independent of the frequency at which it is measured.
   c) Impulse noise voltage is independent of Bandwidth.
   d) Industrial noise is usually of the impulse type.
8. A receiver connected to an antenna whose resistance is 50Ω has an equivalent noise resistance of 30Ω.The equivalent noise temperature of the receiver is
   a) 174K
   b) 290K
   c) 303K
   d) 273K
9. The amount of information if binary digits occur with equal likelihood in binary PCM is
   a) zero
   b) 1 bit
   c) 2 bits
   d) 4 bits
10. The relation between mutual information and joint entropy is
   a) I (X;Y) = H(Y)- H(Y/X)
   b) I (X;Y) = H(X,Y)- H(X/Y)
   c) I (X;Y) = H(X)+H(Y)- H(X,Y)
   d) I (X;Y) = H(X,Y)- H(X)

PART B (10 x 2 = 20 Marks)

11. How many AM broadcast stations can be accommodated in a 100KHz bandwidth if the highest frequency modulating a carrier is 5KHz?
12. Distinguish between low level and high level modulation.
13. Illustrate the relationship between FM and PM, with block diagrams.
14. Determine the percent modulation for a television broadcast station with a maximum frequency deviation Δf=50KHz when the modulating signal produces 40KHz of frequency deviation at the antenna. How much deviation is required to reach 100% modulation of the carrier?
15. Define sensitivity and selectivity of a receiver.
16. What is quadrature carrier multiplexing?
17. Determine the overall noise figure of a three stage cascaded amplifier, each stage having a power gain of 10dB and noise figure of 6dB.
18. Summarize the need for pre emphasis and de emphasis.
19. Calculate the channel capacity of binary symmetric channel with error probability of 0.2.
20. Define differential entropy and mutual information for continuous ensembles.

PART C (5 x 14 = 70 Marks)

21. a) (i) Determine unmodulated carrier amplitude, modulation index and modulating (4)

signal amplitude for an AM DSBFC envelope with a +Vmax= 40 V and +Vmin = 10V.

(ii) Explain the generation of DSB-SC using FET push-pull balanced modulator with the help of a neat diagram. (10)

(OR)

b) (i) Show that the signal (6)

$$v(t) = \sum_{i=1}^{N} [\cos\omega_c t \cos(\omega_i t + \theta_i) - \sin\omega_c t \sin(\omega_i t + \theta_i)]$$

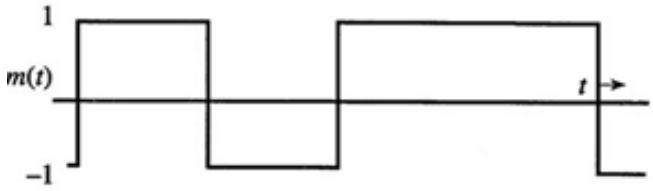
is an SSB-SC signal ($\omega_c \gg \omega_M$). Is it the upper or lower side band?

(ii) A 1000 KHz carrier is simultaneously amplitude modulated with 300 Hz, 800Hz and 1.5KHz audio sine waves. What will be the frequencies present in the output? (4)

(iii) Draw the filtering scheme for the generation and detection of VSB modulated wave. (4)

22. a) (i) Derive the expression for the single tone frequency modulation and draw its frequency spectrum. (8)

(ii) Sketch the FM and PM wave for the modulating signal m(t) shown below for a suitable carrier signal. Given: $K_f = 2\pi \times 10^5$, $K_p = \pi/2$ and f_c=100MHz. (6)



(OR)

b) (i) Explain the Armstrong method for generation of FM signal with block diagram. (10)

(ii) When the modulating frequency in an FM system is 400Hz and the modulating voltage is2.4V, the modulation index is 60. Calculate the maximum deviation. What is the modulating index when the modulating frequency is reduced to 250 Hz and the modulating voltage is simultaneously raised to 3.2V? (4)

23. a) (i) Explain the function of super heterodyne AM receiver with neat diagram. How does it overcome the shortcomings of TRF receiver? (10)

(ii) When a super heterodyne receiver is tuned to 555KHz, its local oscillator provides (4)

the mixer with an input at 1010KHz.What is the image frequency? The antenna of this receiver is connected to the mixer via a tuned circuit whose loaded Q is 40.What will be the rejection ratio for the calculated image frequency?

(OR)

b) (i) Show that the synchronous demodulator can demodulate an AM signal $x_{am}(t) = [A + m(t)]\cos\omega_c t$ regardless of the value of A. (4)

(ii) Discuss the operation of Foster-Seely discriminator with neat circuit diagram. (10)

24. a) (i) Derive the representation of narrowband noise in terms of envelope and phase components and list out its properties. (10)

(ii) Discuss about noise equivalent bandwidth and white noise. (4)

(OR)

b) (i) Sketch the block diagram of DSB-SC / AM system and derive the figure of merit. (8)

(ii) Compare the performance of AM and FM systems. (6)

25. a) Encode the following source using Shannon-Fano and Huffman coding procedures and calculate entropy of the source, average code length, efficiency, redundancy and variance.

Compare the results.

X	x_1	x_2	x_3	x_4	x_5	x_6	x_7
p(X)	0.4	0.2	0.12	0.08	0.08	0.08	0.04

(OR)

b) (i) Calculate the minimum signal-to-noise ratio required to support information transmission through the telephone channel at the rate of 9600 bits/sec with bandwidth of 9.6 KHz. (2)

(ii) Derive the channel capacity for band limited, power limited Gaussian channel and discuss the implication of the same in detail. (12)

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