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Question Paper Code : 21448

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fourth Semester

Electronics and Communication Engineering

EC 2252/EC 42/EC 1252/080290020 — COMMUNICATION THEORY

(Regulations 2008)

(Common to PTEC 2252 Communication Theory for B.E. (Part-Time) Third Semester ECE – Regulations 2009)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. For the baseband signal $m(t) = \cos(w_m t)$, find the DSB-SC signal and sketch its spectrum.

2. Define VSB and state any one of its application.

3. What is the transmission bandwidth of FM?

4. What is indirect method of FM generation?

5. Binary data are transmitted over a noisy communication channel in a block of 16 binary digits. The probability that a received digit is in error due to channel noise is 0.01. Assume that the errors occurring in various digit positions within a block are independent. Find the mean (average number of) errors per block.

6. Can noise temperature be zero? Why?

7. State the principle behind FM threshold effect.

8. Does the reduction in frequency range improve SNR of both SSB and DSB-SC reception? Why?

9. The average information rate is zero for both extremely likely and extremely unlikely message. Is the statement correct? Why?

10. What is lossy source coding?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the Fourier coefficients of the periodic train of pulses of amplitude A and duration τ. (4)

(ii) Describe a method each for generation and demodulation of AM signal. (8)

(iii) Briefly describe FDM. (4)

Or

(b) (i) The signal $m(t)=3\cos(200\pi t)+\sin(600\pi t)$ is used to amplitude modulate the carrier $c(t)=\cos(2\times10^5 t)$. The modulation index is 0.85. Determine the power in the carrier component and in the sideband components of the modulated signal. (5)

(ii) Compare and contrast the amplitude modulation systems. (6)

(iii) With the respective block diagram, describe the balanced modulator. (5)

12. (a) (i) The message signal $m(t)=a\cos(2\pi f_m t)$ is used to either frequency modulate or phase modulate the carrier $A_c\cos(2\pi f_c t)$. Find the modulated signal in each case. (4)

(ii) Bring out the relationship between PM and FM. (4)

(iii) Describe a method each for generation and demodulation of FM signal. (8)

Or

(b) (i) An angle modulated signal has the form $u(t)=100\cos[2\pi f_c t+4\sin 2000\pi t]$ where $f_c=10$ MHz. Determine the average transmitted power, peak phase deviation and peak frequency deviation. Is this an FM or a PM signal? Explain. (6)

(ii) With the relevant expressions and figures (if any), compare and contrast narrowband and wideband FM. (10)

13. (a) (i) Suppose an amplifier is designed with three identical stages, each of which has a gain 5 and a noise figure of 6, determine the overall noise figure of the cascade of the three stages. (3)

(ii) A radio antenna pointed in the direction of the sky has a noise temperature of 50° K. The antenna feeds the received signal to the pre-amplifier, which has a gain of 35 dB over a bandwidth of 10 MHz and a noise figure of 2 dB. Determine the effective noise temperature at the input to the pre-amplifier. Also determine the noise power at the output of the pre-amplifier. (4)

(iii) Discuss in detail about Gaussian process. (9)

Or

(b) (i) In a binary communication system, the input bits transmitted over the channel are either 0 or 1 with probabilities 0.3 and 0.7 respectively. When a bit is transmitted over the channel, it can be either received correctly or incorrectly (due to channel noise). Let us assume that if a 0 is transmitted, the probability of it being received in error is 0.01 and if a 1 is transmitted, the probability of it being received in error is 0.1. What is the probability that the output of this channel is 1? What is the probability that the input to the channel was a 1, assuming we have observed a 1 at the output of this channel? (6)

(ii) Elaborate on (1) Shot noise and (2) Narrow band noise. (10)

14. (a) (i) With a block diagram, describe a superheterodyne receiver. (6)

(ii) Derive the expression for noise in DSB-SC systems employing coherent detection. (10)

Or

(b) (i) Describe Pre-emphasis and De-emphasis. (6)

(ii) A certain communication channel is characterized by a 90 dB attenuation and additive white noise with the power spectral density of $No/2 = 0.5 \times 10^{-14}$ W/Hz. The bandwidth of the message signal is 1.5 MHz and its amplitude is uniformly distributed in the interval [–1, 1]. If we require that the SNR after demodulation be 30 dB, find the necessary transmitter power in (1) DSB-SC modulation and (2) Conventional AM with a modulation index of 0.5. (4)

(iii) Derive the effect of noise in AM system using envelope detection. (6)

15. (a) (i) A discrete memoryless source emits 4 symbols each with probability 0.25. Construct Shannon Fano codes and Huffman codes for this source. (10)

(ii) Discuss in detail about Bandwidth - S/N tradeoff. (6)

Or

(b) (i) Find the capacity of a telephone channel with bandwidth 3000 Hz and SNR 39 dB. (3)

(ii) State the physical meaning of Entropy. Determine the entropy of a discrete memoryless source emitting 5 symbols each with probability 0.2. (3)

(iii) Write short notes on : (1) Mutual information and (2) Rate distortion theory. (10)
