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Question Paper Code : 77116

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Electronics and Communication Engineering

EC 6402 — COMMUNICATION THEORY

(Regulation 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Draw the AM modulated wave for modulation index = 0.5 and its spectra.
2. Define heterodyning.
3. Define lock in range and dynamic range of a PLL.
4. A carrier is frequency - modulated with a sinusoidal signal of 2 kHz resulting in a maximum frequency deviation of 5KHz. Find the bandwidth of the modulated signal.
5. Define the Q factor of a receiver.
6. Write the equation for the mean square value of thermal noise voltage in a resister.
7. What is preemphasis? Why it is needed?
8. Define threshold effect in AM systems.
9. Define entropy and find the entropy of a DMS with probability s1=1/2, s2=1/4 and s3=1/4.
10. State Shannon's Channel capacity theorem.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain with suitable diagrams the generation of AM using squarelaw method. Also derive its efficiency.

(ii) Explain the demodulation of AM using envelope detection.

Or

(b) (i) Explain with block diagram the super heterodyne receiver.

(ii) Explain the Hilbert Transform with an example.

12. (a) An angle modulated signal is described by

$X_c(t) = 10 \cos\left[2\pi(10^6)t + 0.1\sin(10^3)\pi t\right]$.

(i) Considering $X_c(t)$ as a PM signal with kp=10, find m(t). (8)

(ii) Considering $X_c(t)$ as a FM signal with kp=10π, find m(t). (8)

Or

(b) (i) Explain with diagrams the generation of FM using direct method.

(ii) With the phasor representation explains the foster seeley discriminator.

13. (a) (i) Define noise. Explain the various types of internal noise.

(ii) Explain with derivation the effect of noise in cascaded amplifier circuit.

Or

(b) Derive the SNR performance of DSB system and the AM system. Also prove that the output SNR in AM is at least 3 dB worse than that of DSB system.

14. (a) (i) Let X and Y be real random variables with finite second moments. Prove the Cauchy-Schwarz inequality. $(E[XY])^2 \leq E[X^2]E[Y^2]$. (8)

(ii) Differentiate the strict-sense stationary with that of wide sense stationary process. (8)

Or

(b) (i) Let X(t) and Y(t) be both zero-mean and WSS random processes. Consider the random process z(t) = X(t)+Y(t). Determine the auto correlation and power spectrum of z(t) if X(t) and Y(t) are jointly WSS. (8)

(ii) Let X(t) = A cos $(\omega t + \Phi)$ and Y(t)= A sin $(\omega t + \Phi)$, where A and ω are constants and Φ is a uniform random variable $[0, 2\pi]$. Find the cross correlation of x(t) and y(t). (8)

15. (a) A DMS has six symbols $x_1, x_2\ x_3, x_4, x_5, x_6$ with probability of emission 0.2, 0.3, 0.11, 0.16, 0.18, 0.05 encode the source with Huffman and Shannon — fano codes compare its efficiency. (16)

Or

(b) (i) Derive the mutual information I(x;y) for a binary symmetric channel, when the probability of source is equally likely and the probability of channel p=0.5. (6)

(ii) For a source emitting three symbols with probabilities p(X) = {1/8, 1/4, 5/8} and p(Y/X) as given in the table, where X and Y represent the set of transmitted and received symbols respectively, compute H(X), H(X/Y) and H(Y/X). (10)

		y_1	y_2	y_3
	x_1	2/5	2/5	1/5
P(Y/X)	x_2	1/5	2/5	2/5
	x_3	2/5	1/5	2/5