

2125
B.E. (Electrical and Electronics Engineering)
Fifth Semester
PE-EE-504: Communication Systems

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit. Use of scientific calculator is allowed.

x-x-x

- I. (a) What are the differences between PCM and differential PCM?
(b) Write the expression for the instantaneous phase of a CPM signal. Give physical meaning of each term.
(c) What are the main characteristics of Gaussian noise?
(d) How response $H(f)$ of matched filter is related to the signal's spectrum $S(f)$.
(e) What will be the effect of phase noise on QAM signals? (5x2)

UNIT - I

- II. (a) Consider $V_{FM}(t) = 20 \cos(2\pi \times 10^6 t + 0.1 \sin 10^4 t)$ and $K_f = 10\pi$. Write expression for modulating signal.
(b) Draw the phasor diagram of AM signal. A DSB-SC signal is generated by using the carrier $\cos(2\pi f_c t + \theta)$ and modulating signal $x(t)$. Examine the envelop of the DSB-SC signal. (2x5)
- III. (a) Consider an FM wave $f(t) = \cos[2\pi f_c t + \beta_1 \sin 2\pi f_1 t + \beta_2 \sin 2\pi f_2 t]$. Calculate the maximum deviation. Explain Noise Triangle.
(b) Prove that FM wave contains infinite number of sidebands? (2x5)
- IV. (a) The AM modulated signal is $s(t) = 5\cos(1800\pi t) + 20\cos(2000\pi t) + 5\cos(2200\pi t)$.
(i) Find the modulation index (ii) Calculate the ratio of the power in the sidebands to the power in the carrier.
(b) Derive that figure of merit in EM systems is quadratic function of the deviation ratio. (2x5)

P.T.O.

(2)

UNIT - II

- V. Calculate Nyquist sampling rate, when signal $x_1(t)$ is band limited to 2 kHz and $x_2(t)$ is band limited to 3kHz with different combinations as
(i) $x_1(2t)$ (ii) $x_2(t-3)$ (iii) $x_1(t) + x_2(t)$ (iv) $x_1(t) \times x_2(t)$ (v) $x_1(t) * x_2(t)$ (10)
- VI. (a) What is ISI? List the various methods to remove ISI in a communication system. Also state and prove Nyquist first criterion for zero ISI.
(b) Explain Viterbi receiver algorithm in detail. (2x5)
- VII. (a) Explain the principle of Maximum Likelihood Sequence Detection for a band-limited ISI channel. Describe how the likelihood metric is computed and used to select the most probable transmitted sequence.
(b) Explain the principle of Binary Phase Shift Keying (BPSK). Derive the expression for its bandwidth, power spectral density and bit error probability in AWGN. Draw the signal constellation. (2x5)

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