Fifth Semester B.E. Degree Examination, June–July 2009
Analog Communication

Time: 3 hrs.
Max. Marks: 100

Note: 1. Answer any FIVE full questions, selecting atleast TWO questions from each Part.
2. Missing data may be suitably assumed.

PART – A

1. a. Discuss the properties of Gaussian process. (10 Marks)
   b. Define mean, correlation and covariance function. (06 Marks)
   c. A random variable has PDF given by: \( f(x) = 2e^{-2x} \) for \( x \geq 0 \).
      Find the probability that it will take a value between 1 and 3. (04 Marks)

2. a. Define standard form of amplitude modulation and explain the time and frequency domain expression of AM wave. (06 Marks)
   b. Explain with the help of a neat sketch, how a square law modulator is used to generate AM. (08 Marks)
   c. A carrier wave \( 4 \sin (2\pi \times 500 \times 10^3 t) \) volts is amplitude modulated by an audio wave \( [0.2 \sin 3 (2\pi \times 500t)] + 0.1 \sin 5[2\pi \times 500t] \) volts. Determine the upper and lower sideband and sketch the complete spectrum of the modulated wave. Estimate the total power in the sideband. (06 Marks)

3. a. Explain how ring modulator can be used to generate DSB – SC modulation. (10 Marks)
   b. Define Hilbert transform. State and prove the properties of Hilbert transform. (05 Marks)
   c. With neat block diagram, explain the operation quadrature carrier multiplexing. (05 Marks)

4. Explain with neat block diagram of DSB – SC, the following:
   a. Detection using costas receiver. (06 Marks)
   b. Derive the time domain descriptions of VSB modulated signal. (06 Marks)
   c. With a neat block diagram, explain AM radio. (08 Marks)

PART – B

5. a. Derive an expression for the spectrum of FM wave with sinusoidal modulation. (07 Marks)
   b. With neat block diagram, explain Armstrong method of FM generation. (07 Marks)
   c. Compare narrow band and wide band FM. (06 Marks)

6. a. The equation for an FM wave is given by: \( S(t) = 10 \sin [5.7 \times 10^4 t + 5 \sin (12 \times 10^4 t)] \) volts
      Calculate : i) carrier frequency ii) modulation frequency iii) modulation index iv) frequency deviation v) power dissipation in 100\( \Omega \). (05 Marks)
   b. Explain with relevant mathematical expressions the demodulation of a FM signal using PLL. (10 Marks)
   c. In the fig. Q6(c) shown below, find out in the carrier frequency, frequency deviation and modulation index at point A and B. Assume that at the output of the mixer, the additive frequency component is being selected. (05 Marks)

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7. a. Explain the following terms:
   i) Short noise
   ii) Thermal noise
   iii) White noise
   iv) Noise figure
   v) Transit Time Noise.

   b. Derive an expression for overall equivalent noise temperature of the cascade connection of any number of noise for two part network. (10 Marks)

   c. A satellite receiving system consist of a Low Noise Amplifier (LNA) that has a gain of 47dB and a noise temperature of 120°K, a cable with loss of 6.5dB and the main receiver with a noise factor of 7dB. Calculate the equivalent noise temperature of the overall system referred to the input for the following connections.
   i) LNA at the input followed by the cable connecting to the main receiver.
   ii) The input direct to the cable, which is connected to the LNA, which in turn is connected to the main receiver. (85 Marks)

8. Write short notes on:
   a. Pre—emphasis and Define—emphasis in FM. (85 Marks)
   b. Noise in SSB receiver. (86 Marks)
   c. Balanced slope detector. (86 Marks)