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10EC53

Fifth Semester B.E. Degree Examination, July/August 2021
Analog Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Define mean, correlation and covariance function. **(06 Marks)**
b. Define Gaussian process and explain central limit theorem. **(06 Marks)**
c. Define probability density function, explain all properties of probability density function. **(08 Marks)**

2 a. Represent an AM signal both in time domain and frequency domain giving their derivation and its spectrums. **(08 Marks)**
b. Obtain the expression for, (i) Average power (ii) Voltage (iii) Current values in the case of a AM wave. **(06 Marks)**
c. An audio frequency signal $10\sin 2\pi\times 500t$ is used to amplitude modulate a carrier of $50\sin 2\pi\times 10^5$. Assume modulation index = 0.2. Calculate (i) Side band frequencies (ii) Amplitude of each side bands (iii) Band width required (iv) Total power delivered to the load of 600 Ω. **(06 Marks)**

3 a. Name the different types of AM generation. Explain a square law modulator giving its spectrum. **(07 Marks)**
b. Explain a Costas Receiver for demodulation of DSBSC signal. **(07 Marks)**
c. The output voltage of a transmitter is given by $400(1+0.4\cos 6280t)\cos 3.14\times 10^7 t$. This voltage is fed to a load of 600 Ω resistance. Determine (i) Carrier frequency (ii) Modulating frequency (iii) Carrier power (iv) Total power output. **(06 Marks)**

4 a. Give the characteristics of a Hilbert transform and obtain impulse response of Hilbert transform. **(08 Marks)**
b. Explain how to generate a VSB signal and give its frequency spectrum. **(05 Marks)**
c. Explain how to generate a SSB signal by phase discrimination method. **(07 Marks)**

5 a. Obtain an expression for single time sinusoidal FM wave and prove that FM has infinite number of sidebands. **(09 Marks)**
b. Explain Armstrong modulator method for generation of FM wave with neat block diagram. **(06 Marks)**
c. A sinusoidal modulating wave of $Am = 5V$ and $fm = 1kHz$ is applied to a frequency modulator, frequency sensitivity of modulation is 40 Hz/V. The carrier frequency = 50 kHz. Calculate the frequency deviation Δf and modulation index β. **(05 Marks)**

6 a. Explain FM stereo multiplexing with a neat diagram. **(07 Marks)**
b. Explain a linearised model of phase locked loop with a neat block diagram and obtain the value of output voltage V(t). **(06 Marks)**
c. Explain direct method of FM generation giving its circuit diagram. **(07 Marks)**

7 a. Explain the following:
   (i) Thermal noise
   (ii) Noise equivalent band width
   (iii) Equivalent noise temperature. **(09 Marks)**

   b. Derive an expression for noise figure of several networks in cascade. **(07 Marks)**

   c. A mixer circuit has noise figure of 16 dB preceded by an amplifier having a noise figure of 9 dB and the available power gain of amplifier is 25 dB. What is the overall noise figure of the system given in Fig. Q7 (c). **(04 Marks)**

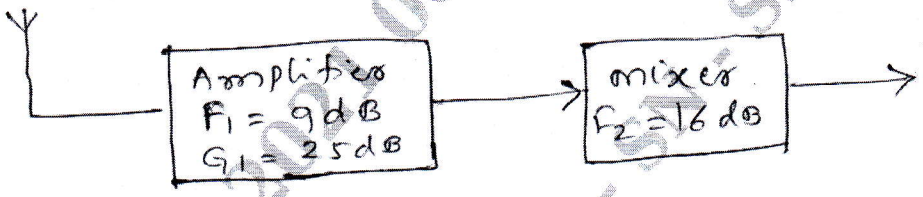

Fig. Q7 (c)

8 a. Calculate the figure of merit in the case of a DSBSC wave. **(07 Marks)**

   b. Explain pre-emphasis and de-emphasis in FM. **(07 Marks)**

   c. The average noise power per unit bandwidth measured at the front end of AM receiver is 1 mW/Hz. The modulating wave is sinusoidal with a carrier power of 80 K watts and sideband power of 10 Kwatts per sideband. The message bandwidth is 4 kHz. Assuming the use of envelope detector in the receiver, determine the ouptupt signal to noise ratio of the system. By how many decibels is the systems inferior to the double side band modulation system. **(06 Marks)**

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