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15EC45

Fourth Semester B.E. Degree Examination, July/August 2021
Principle of Communication Systems

Time: 3 hrs. Max. Marks: 80

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

1 a. Explain in detail Quaderture carrier multiplexing and demultiplexing systems. **(05 Marks)**

b. With relevant equations and diagrams explain the generation of AM waves using switching modulator. **(05 Marks)**

c. Consider a two stage modulator where the message signal occupies a band of 0.3KHz to 4 kHz and the two carrier frequencies are f_1 = 10KHz and f_2 = 100KHz. Evaluate the following :
   i) Sidebands of DSB – SC waves at the output of product modulators
   ii) Sideband at the output of Band pass filters
   iii) Passbands and guard bands of two BPF's
   iv) The order of the two filters assuming at least 15dB attenuation between the passband and stop band. **(06 Marks)**

2 a. Explain the working of practical synchronous cost as receiver system for demodulating DSB – SC wave. **(06 Marks)**

b. Define percentage modulation with relevant equation illustrate the time domain and frequency domain characteristics of single Tone amplitude modulated wave. **(05 Marks)**

c. An audio frequency signal $10\text{Sin } 2\pi \times 500t$ is used to amplitude modulate a carrier of $50 \text{ Sin } 2\pi \times 10^5 t$. Calculate i) Modulation index ii) Sideband frequencies iii) Amplitude of each sideband iv) Bandwidth v) Total power delivered to the load of 600Ω vi) Plot the frequency spectrum. **(05 Marks)**

3 a. Define modulation index, frequency deviation and derive the time domain and frequency domain representation of wide band FM. **(07 Marks)**

b. With relevant diagram, explain the balanced slope method of FM demodulation. **(05 Marks)**

c. An angle modulated signal is represented by $\delta(t) = 10 \text{ Cos}[2\pi \times 10^6 t + 5 \text{ Sin } 2000\pi t + 10 \text{ Sin } 3000 \pi t]$volts. Find the following :
   i) The power in the modulated signal across 1Ω resistor
   ii) Frequency deviation
   iii) The deviation ratio
   iv) The phase deviation
   v) The approximate transmission Bandwidth, B_T. **(04 Marks)**

4 a. With block diagram, explain the linear model of PLL. **(08 Marks)**

b. Write short notes on Non linearity and its effects in FM system. **(04 Marks)**

c. Explain FM stereo multiplexing in detail. **(04 Marks)**

5 a. For a random process X(t), define mean, correlation and covariance function. Explain the properties of autocorrelation function. **(06 Marks)**

b. In a communication receiver, the first stage is a tuned amplifier with an available power gain of 20dB and a noise figure of 10dB. The output of the amplifier is given to the mixer stage whose noise figure is 20dB. Determine the overall noise figure of the system. **(05 Marks)**

c. Show that the area under probability density function curve is always equal to unity. **(05 Marks)**

6 a. Define white noise and plot the power spectral Density and autocorrelation function of Ideal low pass filtered white noise. **(08 Marks)**

b. Define Noise equivalent Bandwidth and derive the expression for the same. **(08 Marks)**

7 a. Show that the figure of merit of a noisy FM receiver for single tone modulation is $\frac{3}{2}\beta^2$. **(08 Marks)**

b. With neat diagram, explain in detail the noisy receiver model. **(05 Marks)**

c. Explain the capture effect in FM. **(03 Marks)**

8 a. Derive the equation for the figure of merit of an AM receiver operating on a single tone AM. **(06 Marks)**

b. Explain FM threshold effect and its reduction methods. **(04 Marks)**

c. Give the importance of pre-emphasis and de-emphasis in frequency modulation. **(06 Marks)**

9 a. State and explain sampling theorem. State Nyquist rate and Nyquist interval. **(10 Marks)**

b. Calculate the nyquist rate and nyquist interval for

i) $x(t) = 3 \text{ Cos } 50\pi t + 10 \text{ Sin } 300\pi t + \text{Cos } 100\pi t$

ii) $x(t) = \frac{1}{2\pi} \text{Cos } (4000\pi t) \text{ Cos } (1000\pi t)$ **(06 Marks)**

10 a. Explain Quantization process Quantization noise and show that the output signal to noise ratio of an uniform quantize increases exponentially with the increasing number of bit per sample. **(10 Marks)**

b. With neat block diagram, explain TDM system. **(06 Marks)**

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