Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 90186

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Third/Fourth Semester
Electronics and Communication Engineering
EC8491 – COMMUNICATION THEORY
(Common to Geoinformatics Engineering/B.E. Computer and Communication Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Let a message signal has bandwidth of W. Write the modulated signal bandwidth if it is modulated by DSBSC and SSBSC.

2. Let a signal $x(t) = A\cos(\omega_c t)$ is passed through a Hilbert transformer. Find the signal at the output y(t) of the Hilbert transformer.

3. Draw the schematic diagram to generate FM signal using phase modulator.

4. Let a frequency modulator has frequency deviation of 75 KHz and modulates a signal with 15 KHz bandwidth, find the modulated signal bandwidth using Carson's rule.

5. Write the condition for two WSS random signals X(t) and Y(t) to be uncorrelated.

6. Find the power spectral density of a WSS random signal X(t) which has autocorrelation $R_x(\tau) = \delta(\tau)$.

7. What is Threshold effect in AM receivers ?

8. A noisy system has noise factor of 2. Find its noise figure and noise equivalent temperature. (Assume reference room temperature is 300K)

9. Draw the schematic diagram to generate PPM signal from PWM signal.

10. In a pulse code modulator, 6 bit encoder has been replaced by a 8 bit encoder. Calculate the SNR improvement offered by the replacement.

PART – B (5×13=65 Marks)

11. a) i) Draw the circuit, design and operation of envelope detector used for AM signal demodulation. (8)

ii) Justify the range of values that can be used for modulation index with illustrations. (5)

(OR)

b) i) Draw the schematic of SSBSC signal modulator using phase discriminator. (6)

ii) Draw the spectrum and explain the generation of SSB-signal using phase discriminator. (7)

12. a) Derive the spectrum of single tone modulated FM signal and discuss its bandwidth based on Carson's rule and Bessel's function.

(OR)

b) Obtain the output SNR of FM demodulator and discuss the importance of pre-emphasis and de-emphasis with their schematic circuits.

13. a) Consider two WSS processes $X(t) = A\cos(\omega t + \theta)$ and $Y(t) = A\sin(\omega t + \theta)$, in which 'A' and '$\omega$' are constants and '$\theta$' is uniformly distributed random variable in $[-\pi, \pi]$. Verify their correlation and independence.

(OR)

b) Consider a signal $X(t) = 2\cos(2000\pi t + \theta) + n(t)$ is passed through an ideal low pass filter with bandwidth of 10 KHz. In the signal, 'θ' is uniformly distributed random variable in $[-\pi, \pi]$ and n(t) is a normal distributed white noise with power spectral density 10^{-6} W/Hz.

i) Draw the spectrum of input and output signals of the filter. (4)

ii) Determine the autocorrelation of input and output signals of the filter. (6)

iii) Estimate the output signal power. (3)

14. a) Derive the Figure of Merit (FoM) for envelope detector for AM signals and coherent receivers for DSBSC receivers in the presence of AWGN and comment.

(OR)

b) Discuss PSD of output noise of an FM demodulator in the presence of AWGN at its input and explain the importance of pre-emphasis and de-emphasis circuits in FM system chain.

15. a) Discuss on distribution of quantization errors in uniform quantizers and derive the relationship between number of bits used in the encoder and signal to quantization noise ratio.

(OR)

b) Draw the block diagram of a pulse code modulation system and discuss the design considerations of each block.

PART – C **(1×15=15 Marks)**

16. a) Consider an AM signal which is obtained by modulating message signal m(t) using a carrier signal $5\cos(2\pi 10^6 t)$ with sensitivity $3\ V^{-1}$. Let $m(t) = \text{sinc}(2000t)$ V. At the receiver input, the signal is corrupted by a white a noise with PSD of 10^{-6} W/Hz. The received signal is passed through an ideal channel select filter before demodulator.

i) Find the transfer of the channel select filter. **(2)**

ii) Draw the PSD of signal at receiver input and demodulator input. **(9)**

iii) Calculate the SNR available at the input and output. **(4)**

(OR)

b) Let a superheterodyne receiver is used to demodulate a broadcast FM signal at 100.5 MHz using frequency discriminator and uses IF of 10.7 MHz with high side injection of LO.

i) Draw the block diagram of the receiver and detail on how it improves sensitivity and selectivity over direct conversion (homodyne) receiver. **(3+4)**

ii) Find LO frequency and image frequency. **(4)**

iii) Comment on the image signal whether it is from or out of broadcast FM band and comment also on the selection of RF filter. **(4)**
