

Roll No.

National Institute of Technology, Delhi
B.Tech (ECE), 4th Semester

Subject: Analog Communication Systems

Time: 3 Hrs

Subject Code: ECB-253

Max. Marks: 50

Section A

Note: Attempt ALL the questions. Assume the necessary data, if applicable.

Q.1

1. What we use for impedance matching in RF amplifiers?
a) RC coupling b) Transformer coupling c) Direct coupling d) RF coupling
2. Frequency spectrum of white noise
a) Extends over finite range b) has flat spectral density
c) Has special density varying as $1/f$ d) has limited number of frequency components
3. A system has a receiver noise resistance of 50Ω. It is connected to antenna with an input resistance of 50Ω. Calculate the noise figure of the system.
a) 1 b) 2 c) 50 d) 101
4. The noise figure of a device is 2. If the input SNR is 37dB. Then calculate output SNR.
a) 18.5dB b) 34dB c) 40dB d) 74dB
5. Amplitude modulation has _____ relationship between the quality of the received signal and the power of the received signal.
a) No b) Non linear c) Constant d) Linear
6. FM has _____ noise immunity when compared to amplitude modulation.
a) Same b) Less c) No d) Better
7. Which of the following is an advantage of AM systems in comparison to FM systems?
a) Occupy less bandwidth b) Superior performance in fading
c) Better noise immunity d) Not susceptible to impulse noise
8. Which of the following is a drawback of FM systems?
a) Burst noise b) Susceptible to atmospheric noise
c) Wider frequency band d) Poor performance in fading
9. Which of the following statement is true about pulse position modulation system?
a) Pulses have constant width but varying amplitude
b) pulses have constant amplitudes and constant widths
c) pulses have constant amplitude but varying widths
d) pulses have varying width and varying amplitude
10. The spectrum of signal is from 200-3200 Hz. Minimum Sampling frequency will be _____
a) 6 kHz b) 3 kHz
c) 1.5 kHz d) 9 kHz

(1*10=10)

Section B

Note: Attempt any FOUR questions. Each Question carries equal marks. Assume the necessary data, if applicable.

- Q: 1 Define Thermal noise. Derive the expression for the addition of noise due to several amplifiers in cascade. (5)
- Q: 2 An AM transmitter supplies 10 kW of carrier power to a 50Ω load. It operates at a carrier frequency of 1.2 MHz and is 80 % modulated by a 3 kHz sine wave.
- (i) Sketch the signal in frequency domain with frequency and power scales. Show the power in dBW.
 - (ii) Calculate the total average power in the signal in Watts and dBW.
 - (iii) Calculate the RMS & Peak voltage of signal. (5)
- Q: 3 (a) In an FM system, the audio frequency is 1 kHz and audio voltage is 2 volts. The deviation is 4 kHz. If the AF voltage is now increased to 8 volts and its frequency dropped to 500 Hz, find the modulation index I each case and the corresponding bandwidth using carson's rule.
- (b) A FM wave is represented by the following relation:
$$V = 10 \sin [5 \times 10^8 t + 4 \sin 1250 t]$$
- (i) Find carrier and modulating frequencies
 - (ii) Determine modulation index and maximum deviation
 - (iii) Find the power dissipated by this wave in 5Ω resistor. (2*2.5=5)
- Q: 4 (a) State and prove Sampling theorem.
- (b) Find the Nyquist rate and Nyquist interval for each of the following signals:
- (i) $x(t) = 5 \cos 1000 \pi t \cos 4000 \pi t$
 - (ii) $x(t) = \sin 200 \pi t / \pi t$ (3+2=5)
- Q: 5 Explain modulation and demodulation of PWM signals in detail with the help of suitable diagrams and waveforms. "PPM is special case of PWM", justify the statement. (5)

Section C

Note: Attempt ALL questions. Each Question carries equal marks.

- Q: 1 (a) Define Image frequency rejection ratio. In a broadcast super hetrodyne receiver having no RF stage, the loaded Q of the aerial coupling circuit is 125. If the intermediate frequency is 465 kHz, Calculate:
- (i) Image frequency and its rejection at 1MHz and 30 MHz
 - (ii) The IF required to make the image rejection ratio as good as 30 MHz as its at 1MHz.
- (b) Describe the generation of SSB-SC signal by Phase discrimination method along with the mathematical analysis with the help of suitable diagrams. (2*5=10)
- Q: 2 (a) Describe Armstrong method for generation of FM Signal with neat and clean diagram and waveforms. Why this method is called Indirect Method?
- (b) List the advantages of Modulation. Explain the difference between Baseband signal, modulating signal, data, carrier signal and modulated signal with suitable waveforms. (2*5=10)

*****BEST WISHES*****