Code No: R193204J **R19** **SET - 1**

III B. Tech II Semester Regular Examinations, June-2022

PRINCIPLES OF COMMUNICATION

(Common to EEE, CSE, IT)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Prove that a coherent detector can reconstruct the original signal in the demodulation of double sideband suppressed carrier amplitude modulation (DSBSC -AM) signal. [8M]
   b) A single tone message signal is given as $m(t) = 4\cos(4\pi 10^3 t)$. Give the expression for single sideband suppressed carrier amplitude modulation for given carrier $c(t) = 10\cos(2\pi 10^6 t)$ and estimate the power required. [7M]

(OR)

2. a) An AM signal is represented as [8M]
   $$s(t) = 5\cos(2\pi 10^6 t)\,[1 + \cos(2\pi 10^3 t)]$$
   Determine the following.
   (i) Message and Carrier signal frequencies
   (ii) Bandwidth Required
   (iii) Total power transmitted
   b) With a neat sketch, explain the generation of DSBSC-AM signal using Ring modulator. [7M]

UNIT-II

3. a) Explain about direct method of FM generation. [8M]
   b) Obtain the following: [7M]
   (i) Carrier Amplitude
   (ii) Message signal Amplitude
   (iii) Carrier Frequency,
   for the given FM signal $s(t) = 10cos(4\pi 10^6 t + 0.5sin4000\pi t)$ when the value of frequency sensitivity is 10 kHz/volt.

(OR)

4. a) Differentiate between Narrowband FM and Wideband FM. [8M]
   b) Discuss about linear and non linear model of phase locked loop (PLL). [7M]

UNIT-III

5. a) State and prove the properties of autocorrelation. [8M]
   b) A discrete random variable X takes values from 1 to 5 with probabilities P(X) as given below. [7M]

X	1	2	3	4	5
P(X)	0.1	0.2	0.4	0.2	0.1

Compute the mean and variance of the random variable X.

|''|'|'|''||''||||

(OR)

6. a) Discuss the important properties of cross correlation. [8M]
   b) Differentiate between white noise, shot noise and thermal noise. [7M]

UNIT-IV

7. a) Examine the statement that figure of merit for DSBSC-AM is unity. [8M]
   b) Identify the significance and importance of Pre-emphasis in analog communication. [7M]

(OR)

8. a) Discuss the Noise in AM receivers and Obtain the expression for signal-to-noise ratio at the input of an AM receiver. [8M]
   b) Illustrate the importance of FM threshold effect. [7M]

UNIT-V

9. a) What do you understand from the word multiplexing? Differentiate between time domain multiplexing and frequency domain multiplexing. [8M]
   b) Classify pulse modulation techniques with their input and output waveforms. [7M]

(OR)

10. a) Define sampling and quantization. With a neat sketch, explain how analog signal is converted to digital signal. [8M]
    b) Obtain the Nyquist rate and Nyquist interval for the given message signal [7M]

$$m(t) = 5\,cos\,6000\pi t + 2.5\,cos\,1000\pi t\,cos\,4000\pi t$$

*****

Code No: R193204J **R19** **SET - 2**

III B. Tech II Semester Regular Examinations, June-2022

PRINCIPLES OF COMMUNICATION

(Common to EEE, CSE, IT)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Show that phase discrimination method can be used to generate single sideband suppressed carrier amplitude modulated (SSBSC- AM) signal. [8M]
   b) Obtain the following for the given amplitude modulated (AM) signal $s(t) = 10\,cos2\pi10^6t(1 + 3cos2\pi10^3t)$: [7M]
      (i) Total power as well as power of sidebands.
      (ii) Frequency domain representation.

(OR)

2. a) Illustrate the significance and importance of Frequency translation in Analog communication. [8M]
   b) Show how to generate DSBSC-AM signal using Ring Modulator. [7M]

UNIT-II

3. a) Summarize the process involved in the generation of narrow band frequency modulation (NBFM) with necessary block diagram. [8M]
   b) Explain the balanced slope detector method for FM demodulation. [7M]

(OR)

4. a) Obtain the expression for an FM signal with a carrier $c(t) = 4cos(2\pi10^6t)$ and message signal $m(t) = 8cos(2\pi10^3t)$. Determine the power of the FM signal when the frequency sensitivity is 1 kHz/Volt. [8M]
   b) Elaborate on the working of Foster Seeley discriminator for FM demodulation. [7M]

UNIT-III

5. a) With necessary equations list the properties of cross correlation. [8M]
   b) A random variable X has $\bar{X} = -3$, $\overline{X^2} = 11$ and $\sigma_X^2 = 2$. For a new random variable $Y = 2X - 3$, find (i) $\bar{Y}$, (ii) $\overline{Y^2}$ and (iii) σ_Y^2. [7M]

(OR)

6. a) List all the properties of probability distribution function. [8M]
   b) Define the terms white noise and Noise figure. Draw the spectrum of white noise with $\sigma_N^2 = 10$. [7M]

|""|'|'|"||""||||

UNIT-IV

7. a) Explain the receiver model for analysis of noise in analog communication. [8M]
   b) Derive the figure of merit for noise in AM receiver. [7M]

(OR)

8. a) Analyze the effect of noise in FM receiver and obtain input and output SNRs. [8M]
   b) Illustrate the importance of threshold effect in noise analysis. [7M]

UNIT-V

9. a) Define Nyquist rate. Explain why Nyquist rate is important in sampling of an analog signal. [8M]
   b) With a neat sketch, explain the working of PCM transmitter and receiver. [7M]

(OR)

10. a) Elaborate on the steps involved in demodulation of PPM with required waveforms. [8M]
    b) Distinguish between ideal, natural and flat top sampling. [7M]

*****

|''|'|'|''||''||||

Code No: R193204J **R19** **SET - 3**

III B. Tech II Semester Regular Examinations, June-2022

PRINCIPLES OF COMMUNICATION

(Common to EEE, CSE, IT)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Define Amplitude modulation and explain the time-domain and frequency-domain representation of AM signal. [8M]
   b) Discuss about the generation of vestigial sideband suppressed carrier amplitude modulated (VSBSC-AM) signal. [7M]

(OR)

2. a) Discriminate between single sideband suppressed carrier amplitude modulation (SSBSC-AM) and vestigial side band suppressed carrier amplitude modulation (VSBSC-AM). [8M]
   b) Estimate the power in the sidebands as well as the transmission efficiency of an amplitude modulated wave given by [7M]
   $$s(t) = 5\,cos2\pi10^6t\,(1 + cos2\pi10^3t)$$

UNIT-II

3. a) Illustrate the importance of phase locked loop (PLL). [8M]
   b) Obtain the (i) Bandwidth (ii) Power required, for the given FM signal $s(t) = 10cos(4\pi10^6t + 5sin4000\pi t)$. [7M]

(OR)

4. a) With a neat block diagram, elaborate on the generation of frequency modulation (FM) using indirect method. [8M]
   b) Estimate the total power as well as bandwidth of an FM signal $s(t) = 5\,cos(4\pi10^6t + 4\,sin\,2500\pi t)$. Also obtain the message and carrier frequencies. [7M]

UNIT-III

5. a) Two statistically independent random variables X and Y with $\overline{X} = 2$, $\overline{X^2} = 8$, $\overline{Y} = 4$, $\overline{Y^2} = 25$. For another random variable given as $W = 3X - Y$, calculate the variance. [8M]
   b) List and prove the properties of probability density function. [7M]

(OR)

6. a) With relevant expressions explain the calculation of mean, correlation and covariance. [8M]
   b) Differentiate between shot noise and thermal noise. [7M]

|""|'|'|"||""||||

UNIT-IV

7. a) Recall the importance of de-emphasis in analog communication. [8M]
   b) Analyze the effect of noise in FM receivers and also obtain the equations for output signal to noise ratio and figure of merit. [7M]

(OR)

8. a) Illustrate the importance of capture effect. [8M]
   b) Derive the figure of merit for DSB-SC receivers. [7M]

UNIT-V

9. a) List out the advantages of converting analog signal to digital signal. [8M]
   b) With neat sketch explain the generation of pulse coded modulation signal. [7M]

(OR)

10. a) Explain the importance of multiplexing. Discuss different types of multiplexing used in analog communication. [8M]
    b) Differentiate the terms sampling, quantization and encoding. [7M]

*****

|'''|'|'|''||'''||||

Code No: R193204J **R19** **SET - 4**

III B. Tech II Semester Regular Examinations, June-2022

PRINCIPLES OF COMMUNICATION

(Common to EEE, CSE, IT)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Outline the process of demodulating the double side band suppressed carrier amplitude modulation (DSBSC-AM) using coherent detection. [8M]
   b) Evaluate the total power of an AM transmitter that radiates 9 kW of power when unmodulated and later modulated by two sine waves with modulation indices 0.5 and 0.6 respectively. [7M]

(OR)

2. a) Compare SSB, DSB and VSB modulation techniques from the view point of generation, bandwidth requirement, power distribution and area of application. [8M]
   b) With a neat block diagram, summarize filter method of generating single sideband suppressed carrier amplitude modulated (SSBSC-AM) signal. [7M]

UNIT-II

3. a) Discuss about Armstrong method for generation of frequency modulated (FM) signal generation. [8M]
   b) Obtain the [7M]
      (i) Carrier Amplitude
      (ii) Message signal Amplitude
      (iii) Carrier Frequency
      (iv) Message signal frequency

   for the given FM signal $s(t) = 5cos\,(2\pi 10^6 t + 0.5sin6000\pi t)$.
   Assume frequency sensitivity as 10 kHz/V.

(OR)

4. a) Explain the important elements of superheterodyne receiver. [8M]
   b) A high frequency carrier signal $c(t) = 2\,cos(2\pi 10^6 t)$ is frequency modulated by a message signal [7M]

   $$m(t) = 4cos(8\pi 10^3 t) + 8\,cos(6\pi 10^3 t)$$

   Obtain the time-domain representation of FM signal. Also calculate the individual modulation indices and maximum frequency deviation.

UNIT-III

5. a) With an example, explain about conditional probability. [8M]
   b) List and prove the properties of probability distribution function. [7M]

|""|'|'|"||""||||

(OR)

6. a) A random variable has a probability density [8M]

$$f_X(x) = \begin{cases} \frac{5}{4}\left(1 - x^4\right), & 0 < x \le 1 \\ 0, & elsewhere \end{cases}$$

Calculate (i) $E[X]$ (ii) $E[4X + 2]$ (iii) $E[X^2]$.

b) Discuss about noise equivalent bandwidth and noise figure. [7M]

UNIT-IV

7. a) Illustrate the importance of capture effect. [8M]

b) Discuss the noise in AM receivers and obtain the expression for signal to noise ratio at the input of an AM receiver. [7M]

(OR)

8. a) Identify the significance and importance of pre-emphasis in analog communication. [8M]

b) Derive the figure of merit for DSB-SC receivers. [7M]

UNIT-V

9. a) Mention the role of a holding circuit in the demodulation of pulse amplitude modulated (PAM) signal with neat block diagram. [8M]

b) Differentiate between PAM, PWM and PPM. [7M]

(OR)

10. a) Illustrate the importance of sampling theorem and Nyquist rate. [8M]

b) Justify the statement that a pulse position modulated (PPM) signal can be generated from a pulse width modulated (PWM) signal. [7M]

*****

|''|'|'|''||''||||