Reg. No. :

Question Paper Code : 40956

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fourth Semester

Electronics and Communication Engineering

EC6402 – COMMUNICATION THEORY

(Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. Compare and contrast DSB-SC with SSB-SC with respect to
   i) power and
   ii) bandwidth.
2. Mention the drawbacks of coherent detector.
3. Differentiate narrow band FM from AM technique.
4. What is the need of limiter circuits in FM system ?
5. Give the mathematical definition for random process.
6. What is narrow band noise ?
7. Defend the reason why, the SNR of the receiver should be high.
8. How does Pre-emphasis and D-emphasis process provide overall SNR improvement in FM systems ?
9. Comment the tradeoff bandwidth and signal to noise ratio.
10. Mention the properties of mutual information.

PART – B (5×13=65 Marks)

11. a) i) Using the concept of Hilbert transform, generate the SSB-SC wave using phase shift method.

   ii) Using suitable circuit, explain the operation of envelope detector. Comment the reason for diagonal clipping and suggest the necessary conditions and expressions to overcome the same.

(OR)

b) i) Defend the need of VSB modulation technique in TV broadcasting. Also sketch its frequency spectra.

ii) With the neat block diagram, elaborate the working principle of AM super heterodyne receiver. Also, highlight how super heterodyne receiver rectifies the drawback of TRF receiver with respect to receiver sensitivity.

12. a) i) Obtain a mathematical expression for FM using Bessel'a function. And also brief the method to determine the bandwidth of FM wave.

ii) Discuss the process of FM generation using reactance modulator.

(OR)

b) i) Highlight the process involved in obtaining amplitude variation from phase variation using suitable FM demodulator circuit.

ii) Elucidate the process of FM demodulation using PLL method.

13. a) i) Consider the quadrature-amplitude modulated signal :

$$Y(t) = X(t)\cos(\omega_0 t) - Z(t)\sin(\omega_0 t),$$

where X(t) and Z(t) are zero-mean independent processes with identical autocorrelations, $R_X = R_Z$. Determine $R_Y(t_1, t_2)$, and show that if $R_X(t_1, t_2) = R_X(t_1 - t_2)$, then $R_Y(t_1, t_2) = R_Y(t_1 - t_2)$.

ii) Discuss the properties of autocorrelation function.

(OR)

b) i) State and explain the properties of Gaussian Process.

ii) Using suitable sketches, expression, explain the transmission of random process through a LTI filter.

14. a) i) Classify the different types of noise and also comment its cause and effects.

ii) Prove that the random band pass noise signal n(t) can be expressed as $n(t) = n_e(t).\cos\omega_c t + n_s(t).\sin\omega_c t$ where $n_e(t)$ and $n_s(t)$ are low frequency signal band limited to ω_m radians/second.

(OR)

b) Obtain an expression for figure of merit for an FM signal, with assumption that the noise added in the channel is Additive White Gaussian Noise.

15. a) i) Derive the channel capacity of band limited Gaussain channel.

ii) Calculate the channel capacity of the channel with the channel matrix shown below :

$$\begin{bmatrix} 0.4 & 0.4 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.4 & 0.4 \end{bmatrix}$$

(OR)

b) i) For the given channel matrix compute the mutual information I(x, y) with $P(x_1) = ½$ and $P(x_2) = ½$.

$P(y/x) =$

	y_1	y_2	y_3
x_1	2/3	1/3	0
x_2	0	1/6	5/6

ii) Construct Huffman code for the following massage set $x = [x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8]$ with probabilities P(x) = [0.07, 0.08, 0.04, 0.26, 0.14, 0.4, 0.005, 0.005]. Compute the coding efficiency and redundancy.

PART – C (1×15=15 Marks)

16. a) Derive the modulated wave equation of an amplitude modulated wave. Obtain power relations also.

(OR)

b) Examine the effectiveness of discrete memory less channels.