(b) The discrete Hilbert Transform is a process by which a signal's negative frequencies are phase-advanced by 90 degrees and the positive frequencies are phase-delayed by 90 degrees. Shifting the results of the Hilbert Transform (+j) and adding it to the original signal creates a complex signal as mentioned in the equation. If $m_i[n]$ is the Hilbert transform of $m_r[n]$, then : $m_c[n] = m_r[n] + jm_i[n]$. Apply the concept of Hilbert transform to generate and detect SSB-SC signal. (15)

Reg. No. :

Question Paper Code : 52911

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Electronics and Communication Engineering

EC 6402 — COMMUNICATION THEORY

(Regulation 2013)

(Common to PTEC 6402 – Communication Theory – For B.E. Part-Time Third Semester – Electronics and Communication Engineering – Regulation 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Suggest a modulation scheme for the broad cast video transmission and justify.

2. What are the advantages of converting low frequency signal in to high frequency signal?

3. A carrier signal is frequency modulated by a sinusoidal signal of 5 Vpp and 10 kHz. If the frequency deviation constant is 1 k Hz/V, determine the maximum frequency deviation and state whether the scheme is narrow band FM or wide band FM.

4. Draw the schematic of FM signal generation using phase modulator.

5. Relate independence and correlation between two random processes.

6. State Wiener Khintchine theorem.

7. What is preemphasis? Why it is needed?

8. Define threshold effect in AM systems.

9. State source coding theorem.

10. State Shanon law.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Derive an expression for output voltage of a balanced modulator to generate DSB-SC and explain its working principle. (5)

(ii) Discuss the detection process of DSB-SC and SSB-SC using coherent detector. Analyze the drawback of the suggested methodology. (8)

Or

(b) (i) Comment the choice of IF selection and image frequency elimination. (5)

(ii) Elucidate the working principle of super heterodyne receiver with the neat block diagram. (8)

12. (a) Derive the expression for frequency spectrum of FM modulated signal and comment on the transmission bandwidth.

Or

(b) With relevant diagrams, explain how the frequency discriminator and PLL are used as frequency demodulators?

13. (a) (i) Two random processes $X(t)=A\cos(\omega t+\theta)$ and $Y(t)=A\sin(\omega t+\theta)$ where A and ω are constants and θ is uniformly distributed random variable in $(0,2\pi)$. Find the cross correlation function. (5)

(ii) Explain in detail about the transmission of a random process through a linear time invariant filter. (8)

Or

(b) (i) When is a random process said to be strict sense stationary (SSS), Wide sense stationary (WSS) and Ergodic process. (6)

(ii) Give a random process, $X(t)=A\cos(wt+\mu)$ where A and w are constants and μ is a uniform random variable. Show that $X(t)$ is ergodic in both mean and auto correlation. (7)

14. (a) (i) Define noise and write notes on Shot noise, Thermal noise and White noise. (5)

(ii) Derive the figure of merit for AM system. Assume envelope detection. (8)

Or

(b) Explain the noise in FM receiver and calculate the figure of merit for a FM system.

15. (a) A DMS has six symbols $x_1, x_2, x_3, x_4, x_5, x_6$ with probability of emission 0.2, 0.3, 0.11, 0.16, 0.18, 0.05 encode the source with Huffman and Shannon – fano codes compare its efficiency. (13)

Or

(b) (i) Derive the mutual information I(x;y) for a binary symmetric channel, when the probability of source is equally likely and the probability of channel $p = 0.5$. (6)

(ii) For a source emitting three symbols with probabilities $p(X)=\{1/8, 1/4, 5/8\}$ and $p(Y/X)$ as given in the table, where X and Y represent the set of transmitted and received symbols respectively. H(X), H(X/Y) and H(Y/X). (7)

P(Y/X)		y_1	y_2	y_3
	x_1	2/5	2/5	1/5
	x_2	1/5	2/5	2/5
	x_3	2/5	1/5	2/5

PART C — (1 × 15 = 15 marks)

16. (a) (i) The AM signal $s(t)=A_c[1+k_a m(t)]\cos(2\pi f_c t)$ is applied to the system shown in Fig.3. Assuming that $|k_a m(t)|<1$ for all t and the message signal $m(t)$ is limited to the interval $-W \le f \le W$ and that the carrier frequency $f_c > 2W$ show that m(t) can be obtained from the square-rooter output $v_3(t)$. (8)

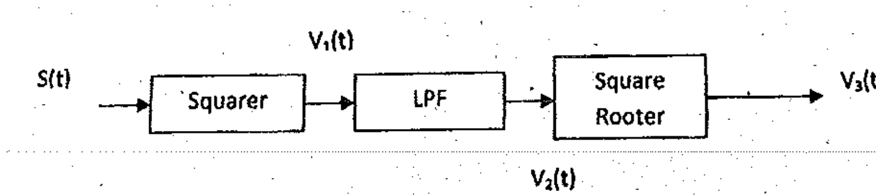

Fig. 3

Consider a square law detector, using a non linear device whose transfer characteristics is defined by $v_2(t)=a_1 v_1(t)+a_2 v_1^2(t)$ where a_1 and a_2 are constants, $v_1(t)$ is the input and $v_2(t)$ is the output. The input consists of the AM wave $v_1(t)=A_c[1+k_a m(t)]\cos(2\pi f_c t)$.

(ii) Evaluate the output $v_2(t)$. (4)

(iii) Find the conditions for which the message signal $m(t)$ may be recovered from $v_2(t)$. (3)

Or