Code No: 115AK

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May - 2018
ANALOG COMMUNICATIONS
(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) What is ring modulator? [2]
b) Describe COSTAS loop. [3]
c) Give comparison of AM techniques. [2]
d) Describe applications of different AM systems. [3]
e) Describe zero crossing detectors. [2]
f) Compare FM and AM. [3]
g) What is pre – emphasis? [2]
h) What is de – emphasis? Draw the diagram. [3]
i) What is time division multiplexing? [2]
j) Explain generation of PPM. [3]

PART – B

(50 Marks)

2.a) Explain switching modulator.
b) A distorted form of a sinusoidal wave $\cos^3\omega_c t$ is available. To obtain DSB – SC signal, a modulating signal f(t) is multiplied by this distorted carrier waveform. Find and sketch of the product $f(t)\cos^3\omega_c t$. How can the desired modulated signal $f(t)\cos\omega_c t$ be obtained from this product? [4+6]

OR

3.a) Explain the envelope detector.
b) Consider an AM signal $\phi_{am}(t) = (1 + A\cos\omega_m t)\cos\omega_c t$, where the message signal frequency ω_m = 5 KHz and the carrier frequency, ω_c = 100 KHz. The constant A = 15. Can this signal be demodulated by an envelope detector? What will be the output of the envelope detector? Find the frequency spectrum of the envelope detector output. [4+6]

4. Single – sideband modulation (SSBM) may be viewed as a hybrid form of AM and FM. Evaluate the envelope and instantaneous frequency of an SSB wave for the following two cases:
a) When only the upper sideband is transmitted.
b) When only the lower sideband is transmitted. [5+5]

OR

5. Explain vestigial side band modulation. [10]

6.a) Explain direct FM.

b) A 100 MHz carrier is frequency modulated by a sinusoidal signal of 10 KHz so that the maximum frequency deviation is 1 MHz. Determine the approximate bandwidth of the FM carrier. Now find the bandwidth of the FM carrier if the modulating signal amplitude is doubled. Determine the bandwidth of the FM carrier if the frequency of the modulating signal is also doubled. [4+6]

OR

7.a) Explain phase locked loop.

b) An angle modulated wave is described by an equation

$$\Phi(t) = 10 \cos(2\times10^6 \pi t + 10 \cos 2000\pi t)$$

Find:
i) The power of the modulated signal,
ii) The maximum frequency deviation
iii) The maximum phase deviation,
iv) The bandwidth of the signal. [4+6]

8.a) Explain average noise figure of cascaded networks.

b) Let a message signal m(t) be transmitted using SSB modulation. The power spectral density (PSD) of m(t) is

$$S_M(f) = \begin{cases} a|f|/W, & |f| \le W \\ 0 \quad , & otherwise \end{cases}$$

Where 'a' and 'W' are constants. White Gaussian noise of zero mean and PSD $N_o/2$ is added to the SSB modulated wave at the receiver input. Find an expression for the output SNR of the receiver. [4+6]

OR

9.a) Describe noise in DSB and SSB systems.

b) An unmodulated carrier of amplitude A, and frequency f_c and band – limited white noise are summed and then passed through an ideal envelope detector. Assume the noise spectral density to be of height $N_o/2$ and bandwidth 2W, centered about the carrier frequency, f_c. Determine the output SNR for the case when the carrier – to – noise ratio is high. [4+6]

10.a) Describe PAM (single polarity, double polarity).

b) The signals given below are not band limited. However, they can be approximated as band limited signals. Assume a suitable criterion for such an approximation in each case and find the corresponding minimum sampling rate.
i) $e^{-2|t|}$, ii) $e^{-2t}\cos 100t\, u(t)$, iii) $t\, e^{-t}\, u(t)$, iv) $G_{20}(t)$. [4+6]

OR

11.a) Explain generation and demodulation of PWM.

b) Generalize the uniform sampling theorem for signals whose spectra are band limited to f_m Hz but not centered at $\omega = 0$. The positive spectrum of such signals lies between f_l and f_h where $f_h - f_l = f_m$. Show that the minimum uniform sampling rate for such signals must be $2 f_h/n$ samples per second where f_h is the highest frequency of the spectrum and n is the largest integer less than f_h/f_m. [4+6]

---ooOoo---