

## FIFTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION DECEMBER 2018/JANUARY 2019 SUBJECT: ANALOG COMMUNICATION (ECE - 3103)

## **TIME: 3 HOURS**

MAX. MARKS: 50

## **Instructions to candidates**

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- 1A. Let x(t) be a periodic signal with period T. The signal is defined over [-T/2, T/2] as follows:

$$x(t) = \begin{cases} 0, & \frac{-T}{2} \le t \le -\alpha T \\ -1, & -\alpha T \le t \le 0 \\ 1, & 0 \le t \le \alpha T \\ 0, & \alpha T \le t \le \frac{T}{2} \end{cases}$$

Find Fourier series coefficients  $a_0$ ,  $a_n$  and  $b_n$ .

- 1B. Determine the Fourier transform of damped sinusoid wave  $g(t) = e^{-t} \sin(2\pi f_c t)u(t)$ .
- 1C. Find the average power of the periodic signal  $g(t) = Acos(2\pi f_1 t + \theta) + Bcos(2\pi f_2 t + \varphi)$ . Assume  $f_1 \neq f_2$ .

(4+3+3)

2A. Consider two energy signals  $g_1(t)$  and  $g_2(t)$  defined as follows:

$$g_{1}(t) = \begin{cases} 1, -3 \le t \le 3\\ 0, \text{ Otherwise.} \end{cases} \text{ and } g_{2}(t) = \begin{cases} -1, 1 \le |t| \le 3\\ 1, 0 \le |t| < 1\\ 0, |t| > 3 \end{cases}$$

Determine and plot the cross-correlation between  $g_1(t)$  and  $g_2(t)$ . Show that  $g_1(t)$  and  $g_2(t)$  are not orthogonal to each other.

- 2B. Determine and sketch the autocorrelation function of the decaying exponential pulse,  $g(t) = e^{-at}u(t)$ , where u(t) is step function.
- <sup>2</sup>C. Mention the properties of Hilbert transform.

(4+3+3)

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- 3A. With the neat block diagram, derive the expressions for demodulation of FM signal using balanced frequency discriminator method.
- 3B. Consider an angle modulated signal s(t) = 10cos(2πf<sub>c</sub>t + 3sin1000πt).
  (a) If this wave is phase modulated signal then compute the modulation index
  (b) If this wave is frequency modulated signal then compute the modulation index.
- 3C. In a FDM system, DSBSC modulation is used to transmit 20 independent voice input of each 3.4KHZ bandwidth. Determine minimum transmission bandwidth that must be provided by the communication channel to transmit this voice input successfully

(4+3+3)

- 4A. With relevant circuit diagram and waveforms, derive the expression for the amplitude modulated wave at the output of the switching modulator. Mention the bandpass filter specifications required for the removal of unwanted terms at the output of switching modulator.
- 4B. With neat block diagram explain the working of FM stereo multiplexing.
- 4C. Evaluate the effect of (i) phase error and the (ii) frequency error in the local oscillator of the coherent DSBSC demodulator.

(4+3+3)

- 5A. Explain with suitable mathematical expressions and neat block diagram, the phase discrimination method of generating SSB signal. Hence derive the time-domain expression for a SSB-USB (Upper sideband) modulated wave.
- 5B. Two identical amplifiers are connected in cascade. The overall power gain is 1600 and the overall noise figure is 5.1.Determine the available power gain and noise figure of individual stages.
- 5C. Obtain an expression for output SNR ( $(SNR)_{O,SSB}$ ) of a noisy SSB receiver.

(4+3+3)