Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FIFTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016
SUBJECT: ANALOG COMMUNICATION (ECE - 3103)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Determine and plot the power spectral density and autocorrelation function of a rectangular signal, one period of which is defined by,

$$g_p(t)=\begin{cases} A, & -\frac{T_o}{8}\le t\le\frac{T_o}{8} \\ 0, & \textit{for remainder of the period} \end{cases}$$

1B. Consider a rectangular pulse *x(t)* of unit amplitude and duration T is applied to an ideal low pass filter of bandwidth B. Determine the response of the filter.

1C. Show that the signal x(t) and its Hilbert transform $\hat{x}(t)$ have the same amplitude spectrum.

(5+3+2)

2A. Determine the cross-correlation function $R_{12}(\tau)$ of the rectangular pulses $g_1(t)$ and $g_2(t)$ shown in Figure Q2A and sketch the same.

2B. Obtain an expression for the figure of merit of a noisy AM receiver, which uses envelope detection.

2C. Find the energy spectral density of the pulse g(t) shown in Figure Q2C.

(5+3+2)

3A. With relevant circuit diagram and waveforms derive the expression for the modulated wave at the output of the switching modulator. Mention the filter specifications required to choose the modulated wave.

3B. With neat block diagram, explain quadrature carrier multiplexing system.

3C. Prove that modulation index for a standard AM wave is $\mu = \frac{A_{max}-A_{min}}{A_{max}+A_{min}}$, where A_{max} and A_{min} are the maximum and minimum amplitude of the AM wave.

(5+3+2)

4A. Using suitable mathematical model, derive the time-domain expression for an SSB modulated wave. Explain an SSB modulator with neat block diagram obtained from this expression.

4B. Consider a composite wave obtained by adding a non-coherent carrier $A_c\cos(2\pi f_c t+\emptyset)$ to a DSBSC wave. This composite wave is applied to an ideal envelope detector. Draw the circuit diagram of an envelope detector and find the resulting detector output. Evaluate this output for $\emptyset$=0.

4C. In a communication receiver, the first stage is a tuned amplifier with an available power gain of 20dB and noise figure of 10dB.The output of the amplifier is given to mixer stage, whose noise figure is 20dB. Determine the overall Noise figure of the System in dB.

(5+3+2)

5A. With neat block diagram and relevant expressions, explain the demodulation of FM using PLL.

5B. A single-tone FM signal is given by $s(t) = 10\sin(16\pi 10^6 t + 20\sin 2\pi 10^3 t)$ volts. Determine the modulation index, frequency deviation, carrier frequency, modulating signal frequency , power and bandwidth of the FM signal.

5C. Two identical amplifiers are connected in cascade. The overall available power gain is 1600 and the overall Noise Figure is 5. Determine the available power gain and Noise Figure of individual stages.

(5+3+2)

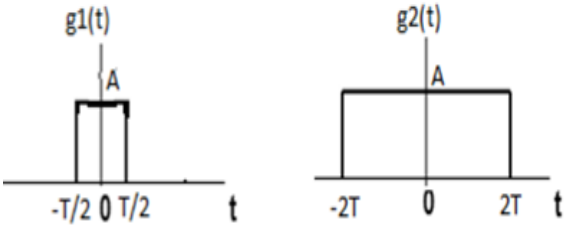

Figure Q2A

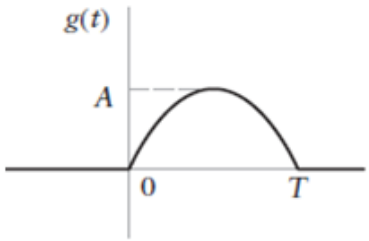

Figure Q2C