Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

FIFTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
NOVEMBER 2018
SUBJECT: ANALOG COMMUNICATION (ECE - 3103)

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

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

1A. Consider a function $g(t)=g_e(t)+g_o(t)$ having even part and an odd part. The even part of the function is defined by $g_e(t)=\frac{1}{2}[g(t)+g(-t)]$ and the odd part defined by $g_o(t)=\frac{1}{2}[g(t)-g(-t)]$. Determine $g_e(t)$ and $g_0(t)$ in terms of the given rectangular function $g(t)=A\,rect\left(\frac{t}{T}-\frac{1}{2}\right)$. Also, determine the Fourier transform of $g_e(t)$ and $g_0(t)$.

1B. Derive the expression for the average power of a periodic signal in terms of complex Fourier Series coefficients.

1C. If $\hat{x}(t)$ is the Hilbert transform of *x(t)*, determine the Hilbert transform of $\hat{x}(t)$

(4+3+3)

2A. Consider the periodic signal, $g_p(t)$ having period T_0=4sec, defined by

$$g_p(t)=\begin{cases}1, & -1\le t\le 1\\ -1, & \textit{for the remainder of the period}.\end{cases}$$

Find the power spectral density, average power and autocorrelation function of $g_p(t)$. Plot the autocorrelation function

2B. Consider a function $g(t)=A\,rect\left(\frac{t}{T}\right)\cos\left(\frac{\pi t}{T}\right)$ .Determine the energy spectral density of this function.

2C. State Dirichlet's conditions to be satisfied for the representation of periodic signal in Fourier series.

(4+3+3)

3A. Explain the demodulation of FM signal using Phase Locked Loop with relevant equations and block diagram.

3B. A carrier wave of $c(t)=8\cos(2\pi\times10^6 t)$ is frequency modulated by a modulating signal $m(t)=5\cos(2000\pi t)+6\cos(3000\pi t)$. The frequency sensitivity of the modulator is $10^3\,Hz/volt$. Obtain the time-domain expression for the FM wave and hence compute

(i) The average power in modulated wave (ii) The maximum frequency deviation

(iii) The deviation ratio (or modulation index) (iv) The transmission bandwidth using

Carson's rule

3C. With a neat block diagram, explain Costas loop used in demodulation of message signal.

(4+3+3)

4A. With relevant diagram and waveforms, derive the expression for the amplitude modulated wave at the output of the square law modulator. Mention the filter specifications required to choose the modulated wave.

4B. Design a frequency modulator for the generation of WBFM signal with Δf=20KHZ and f_c=96MHZ, using narrow band carrier as 200KHZ and frequency deviation 10HZ and mixer oscillator frequency as 12.4MHZ.

4C. With a neat block diagram, explain AM superheterodyne receiver.

(4+3+3)

5A. Mention the advantages of Vestigial sideband modulation technique over other amplitude modulation techniques. Derive an expression for the necessary conditions in the VSB system and also obtain time domain expression for VSB signal

5B. The gain of cascade of 3 amplifiers are G1=10dB, G2=100, G3=40dB and noise factors are F2=7dB and F3=13dB. The equivalent noise temperature of the first stage is 40K. Determine the equivalent noise temperature of the cascade. Assume operating temperature to be 300K.

5C. Obtain an expression for output SNR ($(SNR)_{O,DSB}$) of a noisy DSB-SC receiver.

(4+3+3)