Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FIFTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2015
SUBJECT: ANALOG COMMUNICATION (ECE - 301)

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

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Determine the Fourier transform of the periodic signal gp(t)with period T_1 seconds. The generating function of gp(t) is given by, $g(t) = A\,rect\left(\frac{t+\frac{T}{2}}{T}\right) - A\,rect\left(\frac{t-T/2}{T}\right)$ *with* $2T < T_1$

1B. In a coherent detection of SSB modulated wave, if local carrier is $\cos(2\pi f_c t + \phi)$, prove that there is a phase error in the output and output consists not only the message signal but also its Hilbert transform

1C. Two identical amplifiers are connected in cascade. The overall available power gain is 32.04dB and the overall noise figure is 7.08dB. Determine the available power gain and noise figure of individual stages.

(5+3+2)

2A. With the help of block diagram and necessary mathematical steps, describe how PLL is used in demodulation of FM waves. Also, show that PLL implementation can be simplified using adder, integrator and sinusoidal calculator units.

2B. Find the autocorrelation function of $g_p(t) = A_1 cos(2\pi f_1 t + \theta) + A_2 sin(2\pi f_2 t + \emptyset)$ for $\theta \neq \phi$.

2C. Let the NBFM signal $s(t) = 10\cos(2\pi f_c t + \beta \sin(2\pi f_m t))$ be applied to a frequency multiplier, with $\beta < 0.5$ and f_c=200KHz. Let f_m range from 50Hz to 15KHz, and the maximum frequency deviation at the output be 75KHz. Calculate the required frequency multiplication factor and the maximum allowed frequency deviation at the input.

(5+3+2)

3A. Consider the square wave shown in Fig. Q. No 3 (a). Find the power spectral density of this. Also find the total average power and DC power of this signal.

3B. Suppose that a certain random variable has the CDF $F_X(x) = \begin{cases} 0, & x \leq 0 \\ kx^2, & 0 < x \leq 10 \\ 100k, & x > 10 \end{cases}$

Evaluate '*k*'. Find the value of P ($5 < X \leq 7$), plot the corresponding PDF

3C. Discuss the Quadrature null effect of coherent detector of DSBSC wave

(5+3+2)

4A. Two signals, $m_1(t)$ and $m_2(t)$, both band limited to 5000 Hz, are to be transmitted simultaneously over a channel by the multiplexing scheme shown in Fig. Q.No. 4(a). The signal at point *b* is the multiplexed signal, which now modulates a carrier of frequency 20000 Hz. The modulated signal at point *c* is transmitted over a channel.

i. Sketch signal spectra at points *a, b,* and *c*.

ii. What must be the channel bandwidth required to transmit this signal?

iii. Design a receiver to recover signals $m_1(t)$ and $m_2(t)$ from the modulated signal at point *c*.

4B. Let 'X' have a uniform distribution given by, $f_X(x) = \begin{cases} \frac{1}{2\pi}, & 0 \le x \le 2\pi \\ 0, & elsewhere \end{cases}$

Calculate mean, mean square value and variance for the random variable

4C. Check whether given function $R_g(\tau) = A_1 \sin(2\pi f_1 \tau + \frac{\pi}{2})$ is a valid ACF. Give reason.

(5+3+2)

5A. Starting with the DSCB-SC modulated wave, derive the expression for time-domain representation of SSB signal containing only lower-side band. Hence describe phase-discrimination method of generating SSB wave using a neat block diagram

5B. Define Figure of merit of a receiver. Derive an expression for figure of merit of a DSB-SC receiver.

5C. A noise sample obtained has a Gaussian probability density function with mean 0 and variance $N_0/2$. Write an expression and draw a neat plot for this pdf.

(5+3+2)

6A. Draw the circuit diagram of ring modulator. With the relevant expressions and waveforms, show that it can be used to generate DSBSC signal. Mention the filter specifications required to choose DSB-SC wave.

6B. In an amplitude modulation system, the message signal is shown in Fig. Q.No. 6(b) and the carrier frequency is 1 KHz. The modulator output is $S(t) = 2\,[b + 0.5\,m(t)]\cos(2\pi f_c t)$.

a). Determine the average message power.

b). If $b = 0.5$, determine the modulation index and power of modulated signal

6C. Define random process. What are the conditions for random process to be wide sense stationary?

(5+3+2)

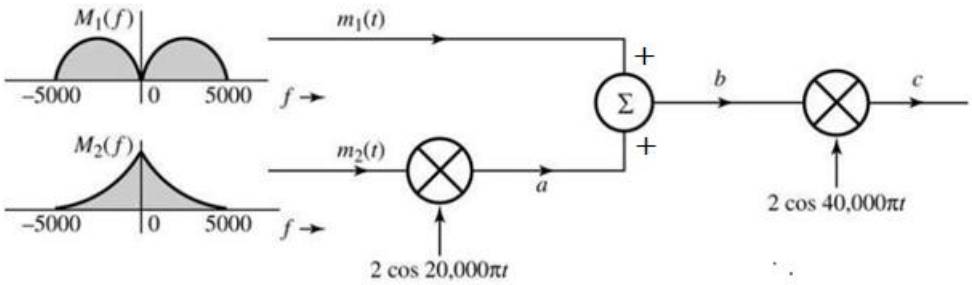

Fig. Q.No. 4(a)

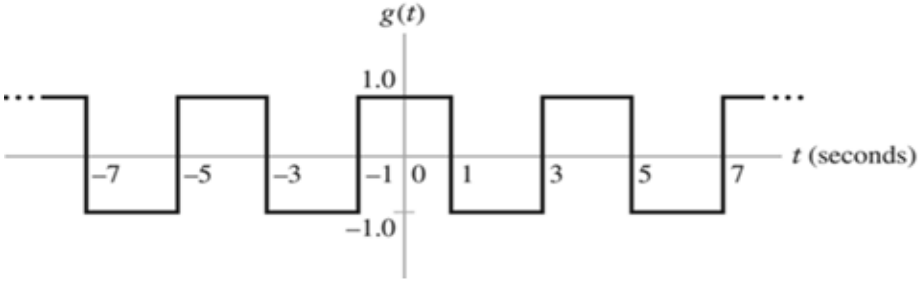

Fig. Q.No 3(a)

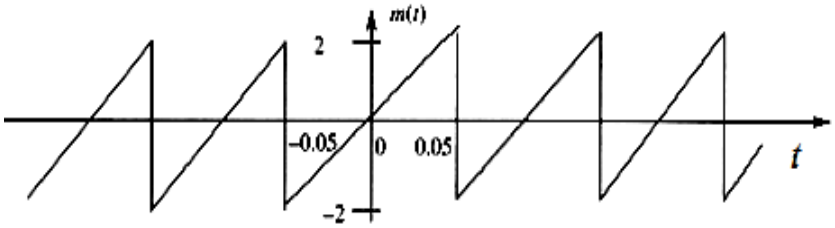

Fig. Q.No. 6(b)