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 – 301)

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

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

1A. Determine and plot the power spectral density and autocorrelation function of a rectangular signal, one period T_0 of which is defined by

$$g_p(t)=\begin{cases} A, & -\frac{T_o}{4}\le t\le\frac{T_o}{4} \\ 0, & \textit{for the remainder of the period} \end{cases}$$

1B. A message signal *m(t)* is applied to a ring modulator. The amplitude spectrum of *m(t)* has a value *M(0)* at zero frequency. Calculate output voltage at $f = \pm f_c, \pm 3f_c, \pm 5f_c \ldots$ where f_c is the fundamental frequency of the square carrier wave *c(t).*

1C. Derive the time domain expression for a single tone FM wave.

(5+3+2)

2A. With a neat circuit diagram, explain working of a Square law Modulator. Also give the specifications of band pass filter to be used to produce a standard AM wave.

2B. With neat block diagram and relevant expressions, explain the indirect method of FM generation.

2C. With block diagram, explain the working of AM radio receiver.

(5+3+2)

3A. For a periodic pulse train $g_p(t)$ as defined below obtain complex Fourier series coefficient and plot both amplitude and phase spectrum for $T/T_0 = 0.4$. Given that period of $g_p(t)$ is T_0.

$$g_p(t) = \begin{cases} -A & 0 \le t \le T \\ 0 & \textit{for rest of period} \end{cases}$$

3B. Consider the message signal m (t) = 20 cos (2π50t) and carrier signal c(t) = 50 cos (2π5000t). Calculate the power developed across 100Ω load, if the carrier is amplitude modulated.

3C. Mention the properties of FM wave.

(5+3+2)

4A. Derive an expression for figure of merit of AM receiver using envelope detector. Also show that $(SNR)_C = 3\,(SNR)_O$ for single tone 100% modulation.

4B. State and prove Parseval's theorem.

4C. Mention the properties of ESD.

(5+3+2)

5A. Derive the time domain expression for SSB signal containing only USB.

5B. State and prove Friis's formula for amplifiers cascaded together.

5C. With block diagram explain the working of zero crossing detector.

(5+3+2)

6A. Consider the two-stage SSB modulator. Given that $m(t) = 5 \cos(1000 \pi t) + 3 \sin (5000 \pi t)$, $c_1(t) = 10 \cos (1\times10^4 \pi t)$ and $c_2(t) = 10 \cos (1\times10^7 \pi t)$. Specify the sidebands at the output of each block used in the SSB modulator for retaining only the upper side band.

6B. Explain the effect of phase error in Coherent detection of DSB-SC modulated signal with relevant expressions.

6C. Obtain the Fourier transform for the pulse $g(t) = exp(-t)\ u(t)$. Plot both magnitude and phase spectrum.

(5+3+2)