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. With a neat circuit diagram and relevant mathematical expressions explain the working of a Switching Modulator. Also give the specifications of band pass filter to be used to produce a standard AM wave.

1B. Explain the working of Costas loop with a neat block diagram and relevant expressions.

1C. Two identical amplifiers are connected in cascade. The overall available power gain is 1600 and the overall noise figure is 5.1. Determine the available power gain and noise figure of individual stages.

(5+3+2)

2A. With relevant block diagram, explain coherent detection system used to demodulate SSB wave. Derive an expression for figure of merit of a SSB receiver using this system.

2B. Show that NBFM is same as AM with a phase shift of 180^0 in one of the sidebands.

2C. Mention any four differences between AM and FM.

(5+3+2)

3A. Consider a message signal containing sinusoidal signals of frequency 100 and 400 Hz. This signal is applied to SSB modulator together with a carrier at 10kHz and only LSB is retained. Give expression for the resulting SSB wave. At the coherent detector, the local oscillator frequency is 100.02 kHz. Determine the frequency components of the detector output.

3B. Consider a signal $g(t)$ defined by

$$g(t) = A_0 + A_1 \cos(2\pi f_1 t + \theta_1) + A_2 \cos(2\pi f_2 t + \theta_2)$$

(i) Determine the autocorrelation function $R_g(\tau)$ of this signal.

(ii) Evaluate the energy of the signal $g(t)$.

3C. When an audio signal 1kHz is frequency modulated and transmitted, the deviation produced is 5kHz. If carrier used has maximum amplitude of 10V and frequency of 100MHz, obtain an expression for FM wave. Calculate the bandwidth using Carson's rule.

(5+3+2)

4A. Explain demodulation of FM signal using Balanced frequency discriminator method with a neat block diagram and relevant expressions.

4B. 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.

4C. Find the Complex Fourier coefficient of a periodic train of rectangular pulses of duration 'T' and

period 'T_0'.

(5+3+2)

5A. State and prove Rayleigh's Energy theorem. Also state the properties of energy spectral density.

5B. With neat block diagram and expressions show that balanced modulator generates AM-DSBSC Signal.

5C. Explain FDM system with a neat block diagram.

(5+3+2)

6A. A periodic signal $g_p(t)$ is defined as below which has a period of 2 seconds. Determine the first three terms in Fourier series expansion of this signal.

$$g_p(t) = \begin{cases} 1+\cos(2\pi t), & -0.5 \le t \le 0.5 \\ 0, & \textit{remainder of period} \end{cases}$$

6B. Explain the working of FM Stereo multiplexing with a neat block diagram.

6C. Derive an expression for total power of AM Signal in terms of carrier power and modulation index.

(5+3+2)