Registration No. : | | | | | | | | | | |

Total number of printed pages – 2

B. Tech

PCEE 4304 (New)

Sixth Semester (Back) Examination – 2013

COMMUNICATION ENGINEERING

BRANCH : EEE

QUESTION CODE : B231

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) State the conditions under which a given signal is Fourier transformable ? What is the Fourier transform of an eternal sinusoid ?

   (b) Give examples of two orthonormal functions. Prove their orthonormality.

   (c) What is (are) the difference(s) between the spectrum of a rectangular pulse and that of a rectangular pulse train ?

   (d) Draw the phase spectrum of a rectangular pulse train. What information does it convey ?

   (e) Give the lowpass to bandpass transformation of a signal and sketch it.

   (f) What is a pilot tone ? Why is it used ?

   (g) What is balanced in a balanced modulator ?

   (h) Is FM a linear modulation scheme ? Justify.

   (i) What is the physical reason for making a slope detector being used as an FM detector ?

   (j) Which part of the spectrum is used as the standard AM broadcast band ? Cite at least two reasons.

2. (a) Explain the need of an RF amplifier as the front end in a standard AM broadcast receiver with a suitable example. Is it essential ? 5

P.T.O.

(b) An angle-modulated signal has the form $u(t) = 100\cos\left[2\pi f_c t + 4\sin \pi f_m t\right]$ where f_c = 10 MHz and f_m = 1 kHz. Assuming this to be an FM signal, determine the modulation index and the transmitted signal bandwidth. Give the expression for the corresponding phase modulated signal. 5

3. (a) Explain the need for an interlaced scanning in TV broadcast. Sketch appropriate sketches. 5

(b) Let a carrier be given by $c(t) = 10\cos(2\pi f_c t)$ and the message signal be $\cos(20\pi t)$. The message signal frequency modulates the carrier with $k_f = 50$. Find an expression for the modulated signal and determine how many harmonics should be selected to contain 99% of the modulated signal power. 5

4. Compare the square-law modulator and the switching modulator used for generating AM signals. 10

5. (a) Give the Fourier transform of a signal given as $x(t) = \sum_{n=-\infty}^{\infty} (-1)^n \delta(t - nT)$. Sketch the magnitude spectrum. 5

(b) Give the Fourier transform of a signal given as $x(t) = \Pi(t-3) + \Pi(t+3)$ where $\Pi(t)$ is a rectangular pulse of unit width. Sketch the magnitude spectrum. 5

6. (a) Show that a signal $x(t)$ and its Hilbert transform $\hat{x}(t)$ are orthogonal. 5

(b) Show that the set of orthogonal signals $\{\phi_n(t)\}_{n=-\infty}^{\infty}$ where $\phi_n = \text{sinc}(2Wt - n)$ represent an orthogonal signal set. 5

7. (a) Compare the three types of sampling. Sketch the sampled waveforms in each case assuming the message signal to be a sinusoid. 5

(b) How do you realize a PCM signal from a PAM signal ? Show the steps very clearly. 5

8. Write short notes on any **two** : 5×2

(a) Fourier transform of periodic signals

(b) Balanced discriminator

(c) Companding

(d) Communication Channels.