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

Total number of printed pages – 3

B. Tech

PCEC 4302

Fifth Semester Regular Examination – 2014

ANALOG COMMUNICATION TECHNIQUES

BRANCH(S) : EC, ETC

QUESTION CODE : H 146

Full Marks – 70

Time : 3 Hours

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*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 relation between the trigonometric series and the complex exponential series representation of the Fourier transform.

(b) State and prove the duality property of Fourier transform.

(c) Give two commonly used basis functions.

(d) State two disadvantages of SSBSC type of communication system.

(e) What are the advantages of a superheterodyne receiver ?

(f) Suggest a simple method to achieve frequency translation. Show that it really performs the task of frequency translation.

(g) Derive a simple expression for modulation index in a phase modulation system when the modulating signal is a pure tone.

(h) What are the primary advantages of pulse time modulation systems ?

(i) In a certain system, SNR is 40 dB. By how much is the signal power above the noise power numerically ? 5

(j) Sketch a narrowband noise with proper labels. 5

2. (a) Find the time domain signal corresponding to $U(-f)$ where $U(.)$ is a unit step function in the frequency domain. Explain the property of Fourier transform that you might have used here. 5

(b) Find the Hilbert transform of $1/t$. 5

3. (a) Prove that the spectrum of a signal given as $x(t) \times y(t)$ is equal to $X(f) * Y(f)$. 5

(b) A signal $m(t) = 10 \cos 200\pi t$ is sampled at a frequency of f_s = 300 Hz. Sketch the spectrum of the sampled signal. Redo the problem for a sampling frequency of f_s = 400 Hz. What is your comment ? 5

4. Compute the mean and variance of a Gaussian random variable given as

$$p(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-m)^2}{2\sigma^2}\right).$$ 10

5. (a) Explain the salient features that a VSB filter must have in order to realize VSB modulation. 5

(b) Explain what kind of detection is carried out to demodulate a VSB modulated signal. 5

6. (a) Express the carrier power as a fraction of the total power in an FM signal characterized with a modulation index equal to 2, with $J_0(2) = 0.224$. 5

(b) Realize a WBFM modulator that works with an lowest input frequency deviation of 49 Hz with a carrier frequency of 200 KHz. Choose appropriate values of multipliers and local oscillator frequency to have a destination frequency deviation of 75 KHz and carrier frequency of 91.2 MHz. Show your block diagram clearly with the designed numerals. 5

7. (a) Discuss suitable circuits for generating PTM signals with appropriate waveforms at each stage. 5

(b) Derive the transfer function of a zero order hold circuit by drawing a neat sketch. 5

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

(a) Low pass filtering of white noise

(b) Figure of merit in DSBFC systems

(c) Noise power at the discriminator output

(d) Additive white Gaussian noise.
