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BMS College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

December 2017 Semester End Main Examinations

Course: Communication Theory-1 **Duration: 3 hrs**
Course Code: 16EC5DCCT1 **Max Marks: 100**
Date: 12.12.2017

Instructions: Answer five full questions choosing one from each unit

UNIT 1

1 a State and explain three properties of autocorrelation function. 7

b Explain i) White Noise ii) Thermal Noise iii) Shot noise. 9

c Consider a random variable X that is uniformly distributed between the values 0 and 1 with probability 0.25, takes on the value 1 with probability 0.25, and is uniformly distributed between the values 1 and 2 with probability 0.5. Determine the distribution function of the random variable X. 4

UNIT 2

2 a Show that an AM wave can be generated using a Non-Linear Device (NLD) whose output is proportional to square of the input. 6

b A composite wave obtained by adding a non-coherent carrier $A_c \cos(2\pi f_c t + \Phi)$ to a DSBSC wave $m(t)\cos(2\pi f_c t)$. The composite wave is then applied to an envelope detector. Evaluate the detector output for 8

i. $\Phi = 0$

ii. $\Phi \neq 0$ and $|m(t)| \ll A_c$

c Explain detection of DSBSC wave using costas loop receiver. 6

OR

3 a Analyse the working of a diode circuit for generating a modulated wave with only two sidebands. 7

b An amplitude modulated waveform has the form $x(t) = 10[1 + 0.5\cos 2000\pi t + 0.5cos4000\pi t]cos20000\pi t$

i. Sketch the amplitude spectrum of x(t)

ii. Find the average power content of each spectral component including the carrier 8

iii. Find Modulation index

c Explain frequency translation with an example. 5

UNIT 3

4 a Suggest a suitable amplitude modulation technique to transmit a message signal which contains significant components at extremely low frequencies such as television signals and provide specification of filter transfer function H(f) of a sideband shaping filter to extract the desired modulated wave considering coherent detector output. 10

b Consider a two stage SSB modulator where the message signal consists of a voice signal occupying the frequency band 0.3 to 3.4 KHz and the two carrier frequencies are f1 = 10KHz and f2 = 100 KHz. Draw the spectrum and evaluate the following (assume that sending only USB)

i. The side bands of DSBSC modulated waves at the output of the product modulators
ii. The sidebands of the SSB modulated waves at the output of band pass filter
iii. The pass band and the guard bands of the two band pass filters. 10

UNIT 4

5 a Define frequency modulation? Show that $s(t) = A_c \Sigma j_n(\beta) \cos 2\pi(f_c+nf_m)t$ for FM wave. 10

b Explain demodulation of FM wave using balanced frequency discriminator. 10

6 a With a neat circuit diagram, describe the direct method of generating FM. Also explain feedback scheme for frequency stabilization of a frequency modulator in direct method. 8

b Derive an expression for FOM of FM receiver. 12

UNIT 5

7 a What do you mean by digital communication? List the advantage of digital communication over analog communication system. 6

b A signal $x(t) = 10cos(20\pi t)cos(200\pi t)$ is sampled at the rate of 250 samples/sec.

i. Determine the spectrum of the sampled wave
ii. Specify the cut off frequency the ideal reconstruction filter so as to recover x(t) from its sampled version.
iii. What is the Nyquist rate? 8

c Explain the working principle of TDM with neat diagram. 6

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