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RE-7087/7088

B. E. - III (E & C / I.C.) (Sem. VI) Examination

May – 2007

Analog & Digital Communication

Time : 3 Hours] [Total Marks : 70

RE-7087

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ B. E. - 3 (E & C / I.C.) (SEM. 6)

Name of the Subject :

☛ ANALOG & DIGITAL COMMUNICATION

☛ Subject Code No. : 7 0 8 7 ☛ Section No. (1, 2,.....) : 1

Seat No. :

Student's Signature

(2) All abbreviations and notations have their usual meanings.

(3) Figures to the right hand side indicate full marks for that question.

(4) Assume suitable data, if required.

1 (a) Select the most appropriate answer from the given multiple options. Justify them in brief. (each question carries equal marks). **10**

(1) Let $\delta(t)$ denote the delta function. The value of the integral $\int_{-\infty}^{\infty} \delta(t) \cos\left(\frac{3t}{2}\right) dt$ is :

(i) 1

(ii) -1

(iii) 0

(iv) $\pi/2$

(2) Double integration of a unit step function would lead to :

(i) an impulse

(ii) a parabola

(iii) a ramp

(iv) a doublet

(3) In amplitude modulation system, if modulation index is raised from 1 to 1.2 then,

(i) power of the wave increases

(ii) efficiency of the transmission increases

(iii) band width increases

(iv) signal gets distorted.

(4) An amplitude modulated voltage in volts is given by $v = 20(1 + 0.5 \sin 6280t)\sin 10^6 t$. The rms value of the un modulated carrier voltage in volts is

(i) 20

(ii) $20/\sqrt{2}$

(iii) 10

(iv) $10/\sqrt{2}$

(5) In FM, the carrier frequency deviation is determined by,

(i) modulating voltage

(ii) modulating frequency

(iii) both modulating voltage and frequency

(iv) none of above.

(b) State and prove frequency shifting property of Fourier transform. 4

(c) Find the trigonometric Fourier series representation for full wave rectified sine wave shown below. 6

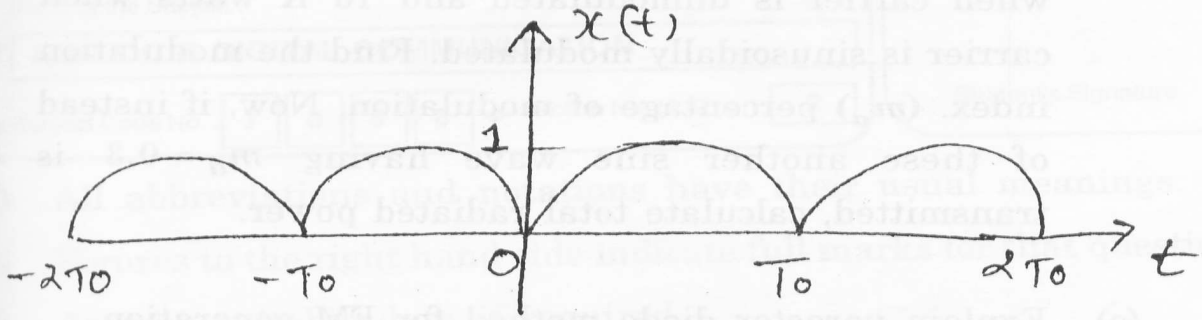

Fig.

2 (a) Explain generation of amplitude modulation (AM) using square law diode modulation technique. Show clearly block diagram and mathematical derivation. 8

(b) The efficiency(h) of ordinary AM is defined as percentage of the total power carried by the sideband, i.e. 7

$$n = \frac{P_s}{P_t} \times 100\%$$

Where P_s – is the power carried by the sidebands and P_t is the total power of AM signal.

(i) Find n for modulation index = 0.70

(ii) Calculate the maximum efficiency for single tone modulated signal with modulation index equal to one (1).

OR

2 (a) Explain demodulation of DSB-SC using synchronous detection. Explain effect of phase and frequency errors in synchronous detection. 8

(b) An AM transmitter radiates 12 K watts of power when carrier is unmodulated and 16 K watts when carrier is sinusoidally modulated. Find the modulation index. (m_a) percentage of modulation. Now, if instead of these another sine wave having $m_a = 0.3$ is transmitted, calculate total radiated power. 7

3 (a) Explain varactor diode method for FM generation. 8

(b) An angle modulated signal is given as : 7
$s(t) = 10 \cos\left(w_c t + 4 \sin w_m t\right)$ - Assuming this as PM signal and $fm = 2\ KHz$, calculate the modulation index and bandwidth when

(i) fm is increased by 3 times and

(ii) fm is decreased by 3 times.

OR

3 (a) Explain with necessary diagrams balanced slope detector method for FM. 8

(b) A 92.6 MHz carrier signal is frequency modulated by a 7 KHz sine wave. The resultant FM signal has a frequency deviation of 50 KHz. Determine the following : 7

(i) carrier swing of FM signal

(ii) The highest and the lowest frequencies attained by the modulated signal.

(iii) The modulation index of FM wave.

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☛ Subject Code No. : 7 0 8 8 ☛ Section No. (1, 2,.....) : 2

Seat No. :

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(3) Figures to the right hand side indicate full marks for that question.

(4) Assume suitable data if required.

1 (a) Each question carries equal marks. **10**

(i) Determine the Nyquist rate for a continuous time signal

$$x(t) = 6\cos 50\pi t + 20\sin 1000\pi t - 10\cos \pi t$$

(ii) What do you mean by synchronization in PAM systems.

(iii) Determine the signal to quantization noise ratio when signal is quantized using 10 bit PCM. How many bits are required for quantization if $S/Nq = 40\ dB$ atleast.

(iv) Compare broadly coherent and non-coherent digital modulation techniques.

(v) A Discrete Memory less source X has four symbols x_1, x_2, x_3 and x_4 with probabilities

$$P(x_1) = 0.4,\ P(x_2) = 0.3,\ P(x_3) = 0.2,\ P(x_4) = 0.1$$

calculate entropy $H(x)$.

(b) What is the transmission bandwidth required for PAM Signal ? Consider same 'ON' and 'OFF' time for PAM. 5

(c) The signal $g(t) = 10 \cos 60\pi + \cos^2 160\,\pi t$ is sampled at the rate of 400 samples/sec. Determine the range of permissible cut off frequencies for an ideal reconstruction filter, that may recover $g(t)$ from its sampled version. What is an importance of low pass filter in communication. 5

5 (a) A DM system is designed to operate at 3 times the Nyquist rate for a signal with 3 KHz bandwidth. The quantizing step size is 250 mV. 7

(i) Determine the maximum amplitude of a 1 KHz input sinusoidal for which the delta modulator does not show slope overload.

(ii) Determine the post filtered output signal to quantizing noise ratio for the signal of part (i).

(b) What is the necessity of non uniform quantization in a PCM system. Explain with suitable example. 8

OR

5 (a) What are the desirable properties of a line code. Explain. 7

(b) Consider an audio signal with spectral component limited to the frequency band of 300 to 4 KHz. A PCM signals is generated with a sampling rate of 8000 samples/sec. The required output signal to quantizing noise ratio is 30 dB. 8

Determine :

(i) Minimum number of uniform quantizing levels needed and minimum number of bits per sample needed.

(ii) Calcuate minimum system bandwidth required.

(iii) Also compare PCM and DM.

6 (a) With the appropriate block diagram explain non coherent detection of FSK. 7

(b) For a transmission scheme obtain the information rate if all the 4 symbols are equally likely. Also comment on the result obtained. 8

OR

6 (a) With the suitable block diagram explain BPSK generation and detection. 8

(b) Show that the channel capacity of an ideal AWGN channel with infinite bandwidth is given by 7

$$C\infty = \frac{1}{1n\ 2\eta}\frac{s}{} \cong 1.44\ \frac{s}{\eta}\ b/s.$$