RE-7087-88-R

B. E. - III (Sem. VI) (ECC / IC) Examination

May / June – 2008

Analog & Digital Communication

Time : 3 Hours] [Total Marks : 100

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 (Sem. 6) (ECC / IC)

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) Assume suitable data wherever necessary.
(3) The acronyms carry their usual meaning.
(4) Figures to right indicate full marks.
(5) Use of programmable calculators is not allowed.

1 (a) Fill in the blanks/select the most appropriate answer with justification. Answer in brief : 10

(i) In AM, the modulation envelope has a peak value double the unmodulated carrier value. The modulation index is _____.

(ii) In which of the following modulation system does the increase of modulation index result in increase in bandwidth ?

(a) AM (b) FM
(c) PM (d) FM and PM both

(iii) Practical bandwidth of a narrow band FM signal equals

(a) $2f_m$ (b) f_m
(c) $2\Delta f$ (d) Δf

(iv) The Fourier transform the Gaussian pulse is

(a) uniform (b) a pair of impulses
(c) Gaussian (d) step

(v) The signal $x(t) = Ae^{-at} .x(t)$, $a > 0$, the signal is

(a) energy signal (b) power signal

(c) both (a) and (b) (d) neither (a) or (b)

(b) The impulse response of continuous time system is 5

expressed as $h(t) = \frac{1}{RC} e^{\frac{-1}{RC}} .u(t)$

Find the frequency response and plot its phase plot.

(c) Obtain the energy spectrum density of Gate function of width T and amplitude A. 5

2 (a) Explain with necessary block diagram and equations quandrature amplitude modulation transmitter and receivers circuits. 7

(b) A 75 MHz carrier signal having amplitude of 5 volt is modulated by 4 kHz audio signal having amplitude of 2 Volt. 8

- Sketch the audio and carrier signal
- Construct the modulated waveform
- Determine % of modulation
- What frequencies will be there in spectrum analysis of modulated signal ?

OR

2 (a) Explain generation of AM wave with collector modulation method. 7

(b) A 3500 Hz audio tone amplitude modulates a 200 kHz carrier resulting in a modulated signal having modulation index of .85. Total transmitted power is 15 kWatts. Find : 8

(i) What frequencies will appear in analysis of modulated wave ?

(ii) Determine the power content of each of the frequencies that appear in spectrum analysis.

3 (a) Draw and explain Varactor diode method for FM generation. 8

(b) A carrier signal is frequency modulated by sinusoidal signal of 2 kHz resulting in a maximum frequency deviation of 5 kHz. 7

(1) Find the bandwidth of the modulated signal.

(2) The amplitude of the modulating signal is increased by factor of 4 and frequency is lowered by 1 kHz. Determine the maximum frequency deviation and the bandwidth of new modulated signal.

OR

3 (a) Explain foster seeley detector method for FM demodulation. 8

(b) Consider an angle modulated signal 7

$X_c(t) = 10 \cos (W_c t + 3 \sin W_m t)$. Assume,

FM is being transmitted, $f_m = 1$ kHz. Calculate the modulation index and find bandwidth when

(i) f_m being doubled (ii) f_m decreased by half.

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Name of the Examination :

☛ B. E. - 3 (Sem. 6) (ECC / IC)

Name of the Subject :

☛ Analog & Digital Communication

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

Seat No. :

Student's Signature

(2) Assume suitable data wherever necessary.
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(4) Figures to right indicate full marks.
(5) Use of programmable calculators is not allowed.

4 Each of the following questions carry equal marks : 20

(a) Explain the difference in base-band modulation and pass band modulation.
(b) What is the difference in frequency spectrum of analog signal and frequency spectra of its sampled version ?
(c) Explain the means by which one can tackle the problem of aliasing.
(d) Quantization noise power is derived as $(\text{Step Size})^2 / 12$. Under what assumptions it holds true.
(e) What are advantages of PCM over other pulse modulation techniques like PAM, PPM and PWM ?
(f) In DM signal is sampled at much higher rate than Nyquist rate. Why ?
(g) Mention four important properties about information.
(h) Mention four desirable properties of a line code.
(i) Justify why in digital communication instead of SNR, Eb/No is used a figure of merit.
(j) What is philosophy of a basic QPSK modulation ?

5 (a) Signal $x_1(t)$ is band-limited to 2 kHz while $x_2(t)$ is band-limited to 3 kHz find the Nyquist sampling rate for 8

(a) $x_1(2t)$
(b) $x_2(t-3)$
(c) $x_1(t) + x_2(t)$
(d) $x_1(t) \cdot x_2(t)$
(e) $x_1(t) * x_2(t)$

(b) With the help of mathematical expressions and diagrams explain the effect of flat top rectangular pulses if used for sampling. 7

OR

5 (a) Consider an audio signal with a spectral component limited to frequency band of 300 to 3300 Hz. A PCM signal is generated with a sampling rate of 8000 samples/sec. The required output signal to quantization noise ratio is 40 dB. Calculate : 9

(i) What is the minimum number of uniform quantizing level needed ?

(ii) What is minimum numbers of bits/sample needed ?

(iii) Calculate the minimum system bandwidth required.

Repeat above computations for output signal to quantization noise ratio is 60 dB. Compare both parts and comment on result.

(b) Consider a binary sequence 1011010. Draw the waveforms for the following signaling format : 6

(i) Unipolar NRZ

(ii) Bipolar RZ

(iii) AMI.

6 (a) Explain the source coding for a Discrete memory less source which produces : 8

(i) Equiprobable symbols

(ii) Nonequiprobable symbols.

(b) Explain the significance of Shannon's Channel capacity theorem. Derive Shannon's lower bound on SNR. 7

OR

6 (a) Compare QPSK and QAM modulation techniques based on bandwidth efficiency, power efficiency, noise immunity, constellation diagrams. 8

(b) Mention the suitable applications for ASK, QPSK, QAM 8 PSK, MSK, FSK, CPFSK. Explain why noise and not an ISI is major constraint in digital wireless communication. 7