AMIETE – ET (OLD SCHEME)

Code: AE15 **Subject: COMMUNICATION ENGINEERING**

Time: 3 Hours **Max. Marks: 100**

JUNE 2010

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: **(2×10)**

a. The autocorrelation function of white noise is

(A) Gaussian **(B)** Constant
(C) Sinusoidal **(D)** A delta function

b. The channel capacity under the Additive White-Gaussian noise environment for a discrete memoryless channel with bandwidth of 4 MHz and SNR of 31 is

(A) 20 Mbps **(B)** 40 Mbps
(C) 124 Mbps **(D)** 10 Mbps.

c. An image uses 512×512 picture elements. Each of the picture elements can take any of the 8 distinguishable intensity levels. The maximum Entropy in the above image will be

(A) 262144 bits **(B)** 784332 bits
(C) 32768 bits **(D)** 64000 bits

d. Aperture effect distortion is related with

(A) Ideal Impulse-train sampling **(B)** Natural sampling
(C) Flat-top sampling **(D)** Pulse-width Modulation

e. In a block code, for correcting t errors, the Hamming distance, d_{min}, should satisfy:

(A) $t \leq d_{min}$ **(B)** $d_{min} \leq t \leq d_{min}+2$
(C) $2t+1 \leq d_{min} \leq 2t+2$ **(D)** $2t \leq d_{min} \leq 2t+1$

f. The Ring Modulator is used for the generation of

(A) SSB-SC signal **(B)** DSB-SC signal
(C) FM signal **(D)** AM signal

g. In a stereophonic FM broadcasting system, the pilot carrier frequency is

(A) 15 kHz **(B)** 75 kHz
(C) 10.7 MHz **(D)** 19 kHz

h. The COHO in MTI radar operates at the

(A) intermediate frequency **(B)** transmitted frequency
(C) received frequency **(D)** pulse repetition frequency

i. Equalizing pulses in TV are sent during

(A) Horizontal blanking **(B)** Vertical blanking
(C) the serrations **(D)** the horizontal retrace

j. An FM signal with a modulation index m_f is passed through a frequency tripler. The wave in the output of tripler will have a modulation index of

(A) $m_f/3$ **(B)** $m_f/9$
(C) m_f **(D)** $3\,m_f$

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q 2. a. Derive an expression for the Equivalent noise resistance at the input of the first stage in a two-stage Amplifier. **(8)**

b. Find the mathematical expression for representation of narrowband noise. **(8)**

Q 3. a. Make a block diagram of phase-shift method of SSB generation to generate the Upper Side Band and write the mathematical expression for a USB-SSB signal. Assume modulating signal is $m(t)$. **(8)**

b. Calculate the percentage power saving when the carrier and one of the sidebands are suppressed in an AM wave modulated to a depth of (a) 100% (b) 50%. **(8)**

Q 4. a. What will happen if a PM signal is received by an FM receiver and vice-versa? Also describe the need of pre-emphasis and de-emphasis in an FM system. **(8)**

b. Describe the working of a basic reactance modulator for the generation of FM signal. Determine the value of the capacitor reactance obtainable from a reactance FET whose g_m is 12 milli-Siemens. Assume that the gate-to-source resistance is one-ninth of the reactance of the gate-to-drain capacitor and that the frequency is 5 MHz. **(8)**

Q5. a. Derive the expression for the signal-to-quantization noise ratio in a PCM system. **(8)**

b. Describe the working of a Delta-Modulator and derive the condition to avoid the slope-overload error for sinusoid of amplitude A and frequency f. **(8)**

Q6. a. There are 8 possible messages m_1 to m_8 with probabilities as given below:

Message	m_1	m_2	m_3	m_4	m_5	m_6	m_7	m_8
Probability	1/2	1/8	1/8	1/16	1/16	1/16	1/32	1/32

Generate a code for these messages using Shannon-Fano Algorithm. **(8)**

b. Describe the Hamming Code in brief. **(8)**

Q7. a. Describe the operation of a CW Doppler radar. Can we use a CW radar for range measurement? Discuss. **(8)**

b. Write a short note on phased array radar. **(8)**

Q8. a. Make a composite TV video waveform at the end of an odd field and explain it. **(8)**

b. Write a note on colour transmission and reception in a TV system. **(8)**

Q9. Write short notes on:

(i) Spectrum and bandwidth of FM signal.
(ii) Adaptive delta-Modulation.
(iii) Channel capacity of a Gaussion channel.
(iv) Recovery of original signal from the samples **(4×4)**