53 (IE 603) CMEN

**2014**

# COMMUNICATION ENGINEERING

**Paper : IE 603**

*Full Marks : 100*

Time : Three hours

***The figures in the margin indicate full marks for the questions.***

*Answer **any five** questions.*

1. *(a)* Draw the waveform of conventional AM and deduce the relation for modulated signal.

   Also, describe a method for demodulation of conventional AM waveform. 8

   *(b)* An AM transmitter has a carrier power of 100 *watt.* The % of modulation is 88%.

   Calculate 4

   *(i)* The total power

   *(ii)* Power in a sideband

(c) Explain how DSB-SC and SSB signal waveforms can be generated. Write relevant mathematical relations. 5

(d) Draw the block diagram of coherent demodulator and explain its operation in brief. 3

2. (a) What is angle modulation ? Deduce the relations for P.M and F.M.

Discuss the relationship between P.M and F.M. 6

(b) Determine the relations for narrow band F.M. and compare its characteristics with conventional A.M. 6

(c) Suppose that a message signal $m(t)$ is a sinusoid of the from $m(t) = a \cos 2\pi f_m t$ and the carrier signal is $c(t) = A_c \cos 2\pi f_c t$.

Determine the expression and draw the spectrum for

(i) Conventional A.M signal

(ii) DSB-SC signal. 6

(d) What is White noise ? Write an expression for white noise. 2

3. (a) A message signal $m(t) = Cos\,2000\pi t + 2cos\,4000\pi t$ modulates the carrier $c(t) = 100\,cos\,2\pi f_c t$ where $f_c = 1MHz$ to produce the DSB signal $m(t).c(t)$

(i) Determine the expression for the upper side band (USB) signal

(ii) Determine and sketch the spectrum of the USB signal. 5

(b) Draw the diagram of switching modulator and explain its operation. 5

(c) Explain using a circuit diagram, how a frequency modulated wave can be generated using varactor diode. 5

(d) Show that the figure of merit in a coherent detector is unity. 5

4. *(a)* Deduce that the figure of merit for frequency modulation is $\frac{3K_f^2P}{W^2}$. 8

*(b)* Explain the process of sampling and quantization in P.C.M. 6

*(c)* What are the digital modulation techniques ? Describe each of them with related expressions and waveforms. 6

5. *(a)* Name the encoding codes used in P.C.M. Using a suitable example, describe each of them. 7

*(b)* What do you understand by companding in P.C.M ? Explain U-law Compander. 5

*(c)* With relevant mathematical relations, describe the process of sampling and reconstruction of an arbitrary signal. 8

6. *(a)* Draw the block diagram of DPCM transmitter and receiver. Explain its operation. 6

*(b)* Discuss the types of noises that occurs in Delta Modulation. 4

(c) The signal

$m(t) = 6\sin(2\pi t)$ volts is transmitting using a 4-bit binary PCM system. The quantizer is of the midrise type, with a step size of 1*volt*. Sketch the resulting PCM wave for one complete cycle of the input.

Assuming a sampling rate of four samples per second, with samples taken at $t = \pm 1/8, \pm 3/8, \pm 5/8$ ....., seconds. 6

(d) Show that the output signal to noise ratio of a uniform quantizer is 4

$$10\log_{10}(SNR)_0 = 1{\cdot}8 + 6R$$

where $R$ is the number of bits per sample.

7. Write short notes on : ***(any two)*** 10×2=20

(a) Demodulation of F.M. wave

(b) Digital Communication System Components

(c) Black and White T.V transmission and reception.

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