DSE-3

2 mark questions

(a) In an FM system, the frequency deviation is about 20·5 kHz and a modulating signal frequency is 5 kHz. Determine the modulation index and carrier swing.

(b) Assume the message signal $x(t) = 15 \cos (2\pi t)$ volts and carrier wave $c(t) = 45 \cos (100\pi t)$ volts. Derive AM wave for 30% modulation.

(c) What is sampling? State sampling theorem.

(d) What is multiplexing? Name the types of multiplexing.

(e) What is demodulation?

(f) Explain the following terms in connection with satellite communication :

    (i) geostationary satellite,

    (ii) uplink and downlink frequencies.

(g) What are SIM and IMEI number in mobile communication?

5 marks questions

(a) (i) Show that the total power of a fully amplitude modulated wave is 1·5 times the unmodulated carrier power.

    (ii) Show that the AM wave can be represented by a carrier and two side bands.   3+2

(b) How can you design an amplitude modulator by using an amplifier whose input v_i and output (v_o) characteristics is $v_o = a_1 v_i + a_2 v_i^2$? where a_1 and a_2 are constants.   5

(c) (i) How is digital modulation different from analog modulation?

    (ii) Describe amplitude shift keying (ASK).

    (iii) Define bit rate.   2+2+1

(d) (i) Find the Nyquist rate for the signal $x(t) = 25 \cos (500\pi t)$.

    (ii) Find the bandwidth of 8-PSK.

    (iii) The upper and lower cut-off frequencies of a resonant circuit are found to be 8·07 MHz and 7·93 MHz respectively. Calculate the bandwidth.   2+2+1

(e) What do you mean by transponder in satellite communication? What are their basic components? 3+2

10 mark questions

3. An audio signal : 15 sin $2\pi(1500t)$
   Amplitude modulates a carrier : 60 sin $2\pi(1000000t)$.
   (a) Sketch the audio signal.
   (b) Sketch the carrier.
   (c) Construct the modulated wave.
   (d) Determine the modulation factor and percentage modulation.
   (e) What are the frequencies of the audio signal and carrier?
   (f) What frequencies would show up in a spectrum analysis of the modulated wave?   1+1+2+2+2+2

4. (a) Find the expression of frequency modulated (FM) wave.
   (b) A 80 MHz carrier is frequency modulated, the modulation index being 4. The frequency of information signal is 10 kHz. What is the maximum frequency deviation?
   (c) What do you mean by resistor noise? Calculate the thermal noise voltage developed in a resistor $R = 100\ \Omega$. The bandwidth of the circuit is 5 kHz at room temperature 30°C.
   (Given $k_B = 1\cdot38\times10^{-23}$ J/K)   3+3+(2+2)

5. (a) Draw the circuit diagram for generation of PAM signal and explain its operation.
   (b) Draw the block diagram of PAM signal reception.
   (c) Draw the circuit diagram of a zero order holding circuit.   (3+3)+2+2

6. (a) Define μ-law for companding. Define unipolar RZ and NRZ.
   (b) What is constellation diagram? Draw the diagram for 8–PSK.
   (c) How can non-uniform quantization be used to increase SNR?   (2+2)+(2+2)+2

7. (a) What is path loss of satellite communication system? How is the path loss related to the gain and power of the transmitting and receiving antenna?
   (b) In satellite communication $P_t = 23\ dB_m$, $G_t = 2dB_i$, $G_r = 2dB_i$, $P_r = -71\ dB_m$. Find the path loss. Where P_t = Power of a transmitter, G_t = Gain of a transmitter, P_r = Power of a receiver, G_t = Gain of a receives.
   (c) Draw the block diagram of Earth station.   (2+3)+3+2

8. (a) What is Carson's rule of thumb for the determination of bandwidth in FM station?
   (b) Describe the basic principle of satellite communication.
   (c) What are the differences among 2G, 3G and 4G technologies in mobile communication system?
                                                                                   3+4+3