Q.2 a. Define Modulation. State need of modulation.

Answer:
Modulation: - The process of modifying the information (message) signal into a form which is suitable for transmission over channel. In which some parameter of carrier wave in accordance with the message signal is Need of Modulation:-

I) Practical antenna
II) To remove interference
III) To reduce noise.

b. A receiver connected to an antenna whose resistance is 50 Ω has an equivalent noise resistance of 30 Ω. Calculate the receiver's noise figure in dB and its equivalent noise temperature

Answer:

F= 1+Req/Ra
= 1+30/50
= 1.6
= 10 log 1.6
= 2.04 db

Teq = To (F-1)

=290 X 1.6

=174 k

c. Discuss addition of noise due to several amplifiers connected in cascade

Answer: 2.3.2 of Text Book

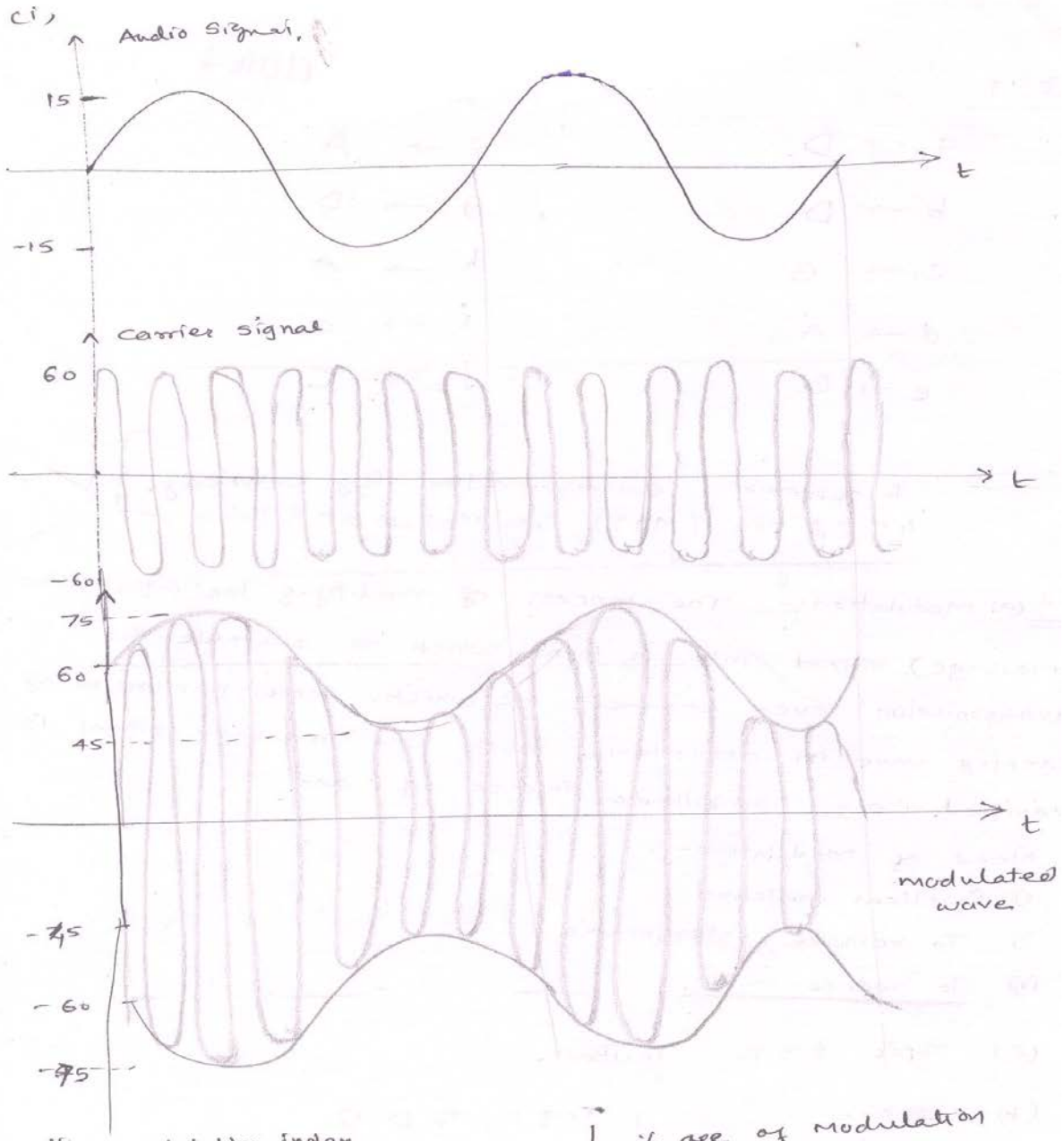
Q.3 a. An audio signal given as 15sin2π (1500t) amplitude modulates a carrier given as 60sin2π (100000t):

(i) Construct the modulated wave.

(ii) Determine the modulation index and percentage of modulation.

Answer:

(i)



(ii) modulation index

$$m = \frac{\text{Max. audio amplitude}}{\text{Max. Carrier amplitude}}$$

$$= \frac{15}{60} = \frac{1}{4} = 0.25 \quad \text{Ans}$$

% age of modulation

$$M = m \times 100$$

$$= 0.25 \times 100$$

$$M = 25\% \quad \text{Ans}$$

b. Discuss the phase shift method to suppress unwanted sideband.

Answer: 4.3.2 of Text Book

Q.4 a. Why FM is called constant bandwidth system?

Answer:
Bandwidth requirements of FM is given by Carson's rule
$B_{FM} = 2(m_f + 1) f_m$ {Bandwidth required to pass an FM wave is twice the sum of the deviation & the highest modulating frequency.}

$B_{FM}=2(\Delta f + f_m)$
Let

$\Delta f = 75$ KHz	$\Delta f = 75$ KHz	$\Delta f = 75$ KHz
$f_m = 0.1$KHz	$f_m = 10$ KHz	$f_m = 10.0$ KHz
$B_{FM} = 2(75+0.1)$	$B_{FM} = 2(75+1)$	$B_{FM} = 2(75+10)$
$= 150.2$ KHz	$= 152$ KHz	$= 170$ KHz
$= 150$ KHz		

From above, when f_m change from 0.1-> 10 KHz i.e. 100 times, BFM varies 150->170 KHz only.
Hence, FM is called constant Bandwidth System.

b. Describe basic reactance modulator used to generate FM signal

Answer: 5.3.2 of Text Book

c. A 25 MHz carrier is modulated by a 40 Hz audio sine wave. If the carrier voltage is 4V and the maximum deviation is 10 kHz, write the equation of this modulated wave for (i) FM and (ii) PM.

Answer:
Calculating the carrier freq. in radians

$w_c = 2\pi \text{ X } 25 \text{ X } 10^6 = 1.57 \text{ X } 10^8$ rad/sec

& $w_m = 2\pi \text{ X } 400 = 2513$ rad/sec

The modulation index $m_f = m_p = 8/f_m$

$= 10{,}000/400 = 25$

Eq. for

FM $V = 4 \sin (1.57 \text{ X } 10^8 t + 25 \sin 2513t)$
PM $V = 4 \sin (1.57 \text{ X } 10^8 t + 25 \sin 2513t)$

Q.5 a. Explain the tuning process with a suitable example.

Answer:
1) Select an AM station ie. 640 KHz

2) Tune the RF amplifier to the lower end of the AM band.

3) Tune the RF amplifier this also tune the local oscillator to a predetermined frequency of 1095 KHz.

4) Mix the 1095 KHz & 640 KHz. This proceeds the following signals are then fed to the Mixes circuit, these signals are then fed to the IF amplifier.

a. 1095 MHz local oscillator freq.
b. 640 KHz Am station carrier frequency.
c. 445 KHz different freq. (ie.a-b)
d. 1.735 KHz sum freq (ie.a+b)

Because of its narrow band width, the IF amplifier rejects all other frequencies but 455 KHz.

b. State requirements of a SSB receiver.

Answer:
1. High reliability & simple maintenance.
2. Excellent suppression of adjacent signals.
3. Ability to demodulate SSB.
4. Good blocking performance.
5. High signal to noise ratio.

c. Discuss the operation of the balanced slope detector, using a circuit diagram and response characteristic.

Answer: 6.4.3 of Text Book

Q.6 a. Draw the following for a transmission line the

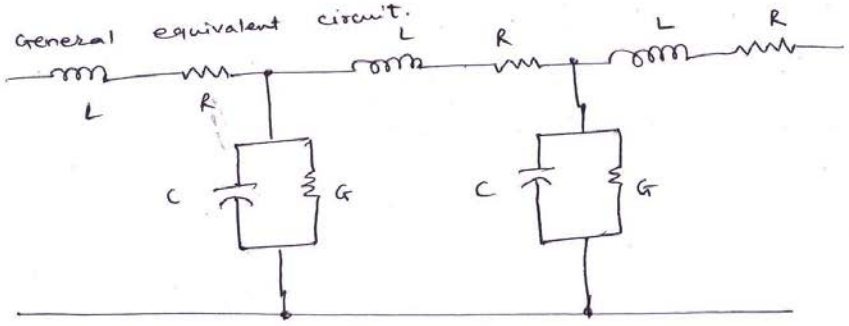
(i) General equivalent circuit

(ii) RF equivalent circuit

(iii) Infinite line

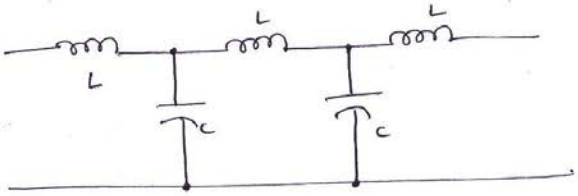
Answer

(i) General equivalent circuit.



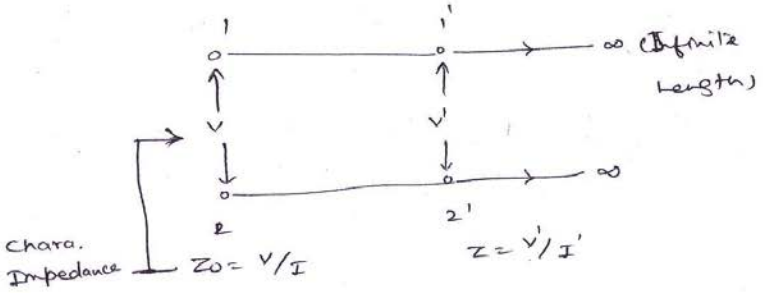
—5—

(ii) RF equivalent circuit



$(X_L >> R)$
Ignoring Reg.

(iii) Infinite line



b. A piece of a coaxial cable has a 75 Ω characteristic impedance and a nominal capacitance of 69 pF/m. What is the inductance per meter? If the diameter of the inner conductor is 0.584 mm and the dielectric constant of the insulation is 2.23, what is the outer conductor diameter?

Answer:

$Z_o = \sqrt{L}/C$ $\quad L = Z_o^2 C = 75^2 \text{ X } 69 \text{ X } 10^{-12} = 0.388\ \mu\text{H/m.}$

$Z_o = 138/\sqrt{k}\ \log D/d$

$= \log D/d = Z_o/(138/\sqrt{k}\ ) = 75/\ 138\sqrt{2.23} = 0.81$

Outer diameter = d X antilog (0.81) = 0.584 X 6.457 = 3.77 mm

c. Explain Baluns as a Transmission line component.

Answer: 7.3.3 of Text Book

Q7 a. A wave guide is propagated in a parallel – plane wave guide. The frequency is 6 GHz and the plane separation is 3 cm. Calculate:

(i) The cut-off wavelength for the dominant mode
(ii) The wavelength in a waveguide in the dominant mode
(iii) The corresponding group velocity
(iv) The corresponding phase velocity

Answer:

Waveguide

(i) The cutoff wavelength for the dominant mode.

$$\lambda_0 = \frac{2a}{m} = 2 \times \frac{3}{1} = 6\text{cm.}$$

(ii) The wavelength in a waveguide in the dominant mode.

$$\lambda = \frac{V_c}{f} = \frac{3 \times 10^{10}}{6 \times 10^9} = \frac{30}{6} = 5cm.$$

$$\rho = \sqrt{1 - \left(\frac{\lambda}{\lambda_0}\right)^2} = \sqrt{1 - (5/6)^2} = 0.553$$

Hence $\lambda_\rho = \frac{\lambda}{\rho} = \frac{5}{0.553} = 9.05cm$

(iii) Group velocity

$$V_g = V_c\rho = 3\times10^8 \times 0.553 = 1.66\times10^8 \text{ m/s}$$

(iv)

$$V_\rho = \frac{V_c}{\rho} = \frac{3\times10^8}{0.553} = 5.43\times10^8 \text{ ms}$$

b. Describe following wave guide components:

(i) Directional coupler
(ii) Two hole coupler

Answer: 10.5 of Text Book

Q8. a. Why commanding is used in Pulse Code Modulation?

Answer: 13.2.4 of Text Book

b. Calculate the information carrying capacity of a standard 4 KHz telephone channel and a signal to noise ratio 28-dB at the input to the receiver.

Answer:

S/N = antilog (28/10) = antilog (2.8) = 631

C_1 = 4000 X $\log_2$ (1 + 631) = 4000 X 9.304

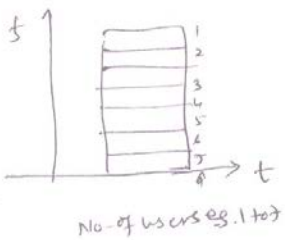
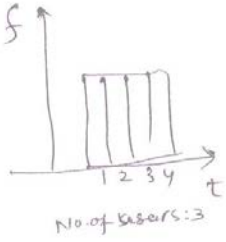
= 37, 216 bits per sec.

c. Discuss principle of PCM in detail.

Answer: 13.2.4 of Text Book

Q9 a. What is multiplexing? Differentiate the two types of multiplexing.

Answer:

Sr No.	Parameter	FDMA	TDMA
1.	Definition	Freq. Band - disjoint Sub Band	time - disjoint time slots.
2.	signal separation	Filtering in freq domain	Synchronization in time domain.
3.	Fig. Used defined.	 No. of users eg. 1 to 7	 No. of users: 3
4.	Gaurd band	Bet freq. in Channels	Bet time slots.

b. Define the following:

(i) Echo suppressors
(ii) Echo cancellers
(iii) International gateway
(iv) Grade of service

Answer: 15.4.3/15.4.4 of Text Book

Text Book

Electronic Communication by Kennedy, 4th Edition (1999), Tata McGraw Hill Publishing Company Limited.