

- Q.2 a. List the basic functions of a radio transmitter and explain briefly the functions. (4)

Answer:

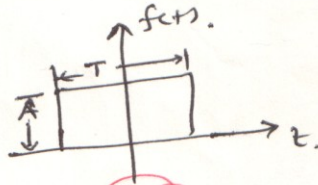
Text Book : (I) Topic 1.2.2 P.N. 03 **4M**

- b. Evaluate a single pulse with an amplitude of 8mV and a first zero crossing at 0.5KHz. (4)

Answer:

Amplitude = 8mv, first zero crossing at 0.5 KHz.  
Pulse width = ?

First zero crossing point  $\omega = 2\pi f = 2\pi/T$   
 $T = 1/f = \frac{1}{0.5 \times 10^3} = 2 \times 10^{-3}$   
 $V_{\text{max transform}} = F(\omega)_{\text{max}} = AT$   
 $\therefore A = \frac{F(\omega)_{\text{max}}}{T} = \frac{8 \times 10^{-3}}{2 \times 10^{-3}} = 4V$   
 i.e. single pulse has a maximum voltage of 4V and a duration of 2 sec.



- c. Discuss the significance of the following terms with reference to noise: (4 × 2)

- (i) Addition of noise due to several sources
- (ii) Signal to Noise ratio
- (iii) Noise figure
- (iv) Noise temperature

Answer:

(C) Text Book (I) **2M**  
 (i) P.N. 2.3-1 P.N. 21 (iii) 2.4.2 P.N. 25 **2M**  
 (ii) 2.4.1 P.N. 25 (iv) 2.5 P.N. 30-32. **2M**

- Q.3 a. Draw and explain the circuit diagram of Grid-modulated class C amplifier used in AM generation. (8)

Answer:

Topic 3.2.2. P.N. 46. Circuit Dia — AM  
Explanation — AM

- b. State the advantages of SSB and calculate the percentage power saving when the carrier and one of the sidebands are suppressed in an AM Wave modulated to a depth of (i) 100 percent (ii) 50 percent. (8)

Answer:

(b) Advantages of SSB (2M)

(i) Less Bandwidth is required. This will allow more no. of signals to be transmitted in the same freq. range

(ii) Power saving: Due to Transmission is only one sideband component. At 100% modulation, the percent-power saving is 83.33%.

(Contd. Q.3(b) ----)

Grid Reduced Interference noise. This is due to the reduced bandwidth. As BW  $\uparrow$ , amount of noise added  $\uparrow$ .

(a) 100% modulation depth (2M)

$$P_t = P_c (1 + \frac{m^2}{2}) = P_c (1 + \frac{1}{2}) = 1.5 P_c$$

$$P_{SB} = P_c \frac{m^2}{4} = P_c \frac{1}{4} = 0.25 P_c$$

$$\text{Savings} = \frac{1.5 - 0.25}{1.5} = 83.3\%$$

(b) 50% modulation depth (2M)

$$P_t = P_c (1 + \frac{0.5^2}{2}) = 1.125 P_c$$

$$P_{SB} = P_c \frac{0.5^2}{4} = 0.0625 P_c$$

$$\text{Savings} = \frac{1.125 - 0.0625}{1.125} = 94.4\%$$

- Q.4 a. Compare the following modulation systems:- (8)

- (i) FM and PM  
(ii) Wideband FM and Narrow band FM

Answer:

(i) <u>AM</u> FM		PM
1. $A(t) = V_c [\sin\{\omega_c t + m_f \sin\omega_m t\}]$		1. $s(t) = V_c [\sin\{\omega_c t + m_p \sin\omega_m t\}]$
2. Freq. deviation is proportional to modulating voltage.		2. Phase deviation is proportional to modulating voltage.
3. Noise immunity is better than PM.		3. Noise immunity is worse than FM.
4. FM - widely used.		4. PM - used in some mobile system
(ii) <u>AM</u> Wide Band FM. $V_b$		Narrow Band FM.
	WB FM.	NBFM.
Para./chara		
1. Modulation index	$> 1$	$< 1$ or slightly $> 1$ at 30 kHz
2. Maximum devi.	75 kHz	0.5 kHz
3. Range of modulating freq.	30 Hz to 15 kHz	30 Hz to 3 kHz.
4. Bandwidth	Large (app. 15 times higher than that of NBFM).	Small.
5. Use:-	Entertainment Broadcasting	FM mobile com.

b. Discuss varactor diode modulator to generate frequency modulated wave. (8)

Answer:

Text Book. Topic 5.3 / P.N. 107-008.

Cap diode  
Explanation

AM  
AM

Q.5 a. Discuss the following terms with reference to receivers: (4 × 2)

- sensitivity
- selectivity
- image frequency
- double spotting

Answer:



Text Book (I) (2M)  
 (i) PN 128 (2M) (ii) PN 125 (2M) (iii) PN 126 (2M) (iv) PN 128 (2M)

- b. Draw the block diagram of Pilot-Carrier single-sideband receiver and explain its operation. (8)

Answer:

(b) Text Book (I) P.N. Topic. 6.5.1. P.N. 176  
 Block Dia - (4M)  
 Operation - (4M)

- Q.6 a. Explain briefly the following concepts with reference to transmission lines:- (8)

- (i) types of losses
- (ii) standing Wave Ratio
- (iii) normalization of impedance
- (iv) characteristic impedance

Answer:

Q.6 (a) Text Book (I)  
 (i) PN. 192 (2M) (ii) PN 195 (2M) (iii) 7.1.2 / 188 (2M) (iv) PN 195 (2M)

- b. Discuss operation of the following with the help of neat diagrams: - (8)
- (i) Baluns
  - (ii) Slotted lines

Answer:

(b) Text Book (I).  
 (i) 7.3.3 / 216 (4M) (ii) 7.3.4 / 217 (4M)

- Q.7 a. Describe group velocity and phase velocity in a wave guide. (4)

Answer:

(a) Group velocity & phase velocity P.N. 322 (4M)

- b. A wave guide is propagated in a parallel – plane wave guide. (4)  
 The frequency is 6 GHz and the plane separation is 3 cm. Calculate:
- (i) The corresponding group velocity
  - (ii) The corresponding phase velocity

Answer:

(b) freq 6 GHz, plane separation is 3cm - Parallel plane W & E  
 Group velocity ? (2M) Phase velocity ? (2M)

$$d_0 = \frac{2a}{m} = \frac{2 \times 3}{1} = 6 \text{ cm} \quad \lambda = \frac{V_c}{f} = \frac{3 \times 10^{10}}{6 \times 10^9} = 5 \text{ cm.}$$

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

$$V_g = V_c \rho = 3 \times 10^8 \times 0.553 = 1.66 \times 10^8 \text{ m/sec.}$$

$$V_p = V_c / \rho = \frac{3 \times 10^8}{0.553} = 5.43 \times 10^8 \text{ m/sec.}$$

c. With the aid of a neat diagram, explain the operation of directional coupler. (8)

Answer:

(b) Topic 10.5-1 / PN 357-358.

Diagram (4M)  
 Explanation (4M)

Q.8 a. Compare Pulse Amplitude Modulation & Pulse Position Modulation. (5)

Answer:

(i) PAM Vs PPM. (4M)

**Pulse Amplitude Mod**

(i) Amp. of pulse  $\propto$  Amp. of modulating signal.

(ii) Bandwidth of Tx channel depends on the width of the pulse.

(iv) Noise interference: High

**Pulse Position Mod**

(i) Relative position of pulse  $\propto$  amp. of modulating signal.

(ii) Bandwidth of Tx channel depends on the rising time of the pulse.

(iv) Noise interference: Min.

(b) (ii) TOPIC ~~13-3~~ 13-3.2 / PN. 510-511

- b. What do you mean by telemetry? What are its applications? Explain the operation of Radiotelemetry transmitter using frequency division multiplex with TDM for subcommutation. (11)

Answer:

TOPIC 13-2-4 / PN 499-501

- Q.9 a. Write short note on TDM. (8)

Answer:

TOPIC 15-1-2 / PN 566

- b. Discuss the following in brief:- (8)
- Co-axial cable
  - Fibre optic links

Answer:

(b) ~~Q.9~~ TOPIC / PN.

(i)	15-2-1	→	569
(ii)	15-2-2	→	571
(iii)	15-2-3	→	571-572
(iv)	15-2-4	→	575-576

### TEXT BOOK

- I. Electronic Communication Systems, George Kennedy and Bernard Davis, Fourth Edition (1999), Tata McGraw Hill Publishing Company Ltd