Numerical Solution

N.1

frequency of message (B) = 5KHz

Channel BW req^d. for each AM station (B_c) = 2X5 KHz

= 10 KHz.

Total no. of AM stations that can be accomodated = $\frac{\text{Total BW}}{\text{BW occupied by each AM stn.}}$

$= \frac{100\,KHz}{10\,KHz} = 10$

Q.N.2 Solution

$m = 0.9$

$P_c = 500W$

$P_t = ?$

$P_t = P_c\left(1+\frac{m^2}{2}\right) = 500\left(1+\frac{0.9^2}{2}\right) = 702.5W$

Q.N.3 Solution

$P_t = 50kW,\ m = 0.95,$

$P_t = P_c\left(1+\frac{m^2}{2}\right)$ i.e. $P_c = \frac{P_t}{1+\frac{m^2}{2}} = \frac{50}{1+\frac{0.95^2}{2}} = 34.45kW$

In A.M. system, $P_t = P_c + P_{USB} + P_{LSB}$

Sideband Power $(P_{USB}+P_{LSB}) = P_t - P_c = 50 - 34.45 = 15.546\,KW$

Q.N.4 Solution

4. $P_c = 10\,KW$, $P_t = 11.2\,KW$,

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

$$\frac{P_t}{P_c} - 1 = \frac{m^2}{2}$$

$\therefore m = 0.4898$ or $\%\ m = 48.98\%$.

When the carrier is simultaneously transmitted with another carrier at $m = 0.5$, the resultant modulation index is given as, $m' = \sqrt{m_1^2 + m_2^2} = \sqrt{0.4898^2 + 0.5^2} = 0.7$

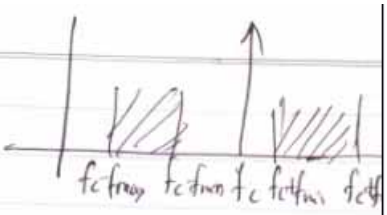
$$P_t = P_c\left(1+\frac{m^2}{2}\right) = 10\left[1+\frac{0.7^2}{2}\right] = 12.45\,KW$$

Q.N. 5 Solution

$f_c = 1000\,KHz$.

$f_{min} = 100\,Hz$

$f_{max} = 500\,Hz$.



(i) frequency span of sideband $= f_{max} - f_{min}$

$= 500\,Hz - 100\,Hz$

$= 400\,Hz$.

(ii) Max^m. upperside frequency $= f_c + f_{max} = 1000 \times 10^3 + 500 = 1000.5\,KHz$

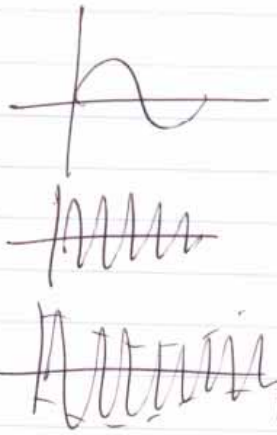
(iii) Min^m lowerside " $= f_c - f_{max} = 1000 - 0.5 = 999.5$ "

(iv) freq. range of channel $= 1000.5 - 999.5 = 1\,KHz$.

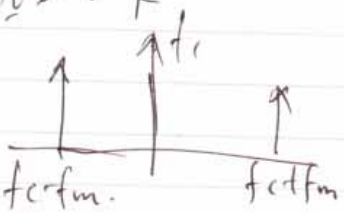
Q.N.6 Solution

$v_m = 15 \sin 2\pi(1500t)$

$v_c = 60 \sin 2\pi(1000000t)$



(b) $m = \frac{V_m}{V_c} = \frac{15}{60} = 0.25$



(c) $f_m = 1500\,Hz$, $f_c = 1000000\,Hz$,

(d) The A.M. wave is given as,

V_{AM} = Carrier signal [1 + mod. index x message signal]

$= 60 \sin(10^5 t)\,[1 + 0.25 \sin 2\pi(1500t)]$

Q.N.7 Solution

$f_{m(min)} = 100\,Hz$

$f_{m(max)} = 10\,KHz$

$f_c = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{100\times10^{-12}\times100\times10^{-6}}} = 1591$

frequency range occupied by sidebands

LSB.