66003

Q4 –b) A carrier wave of frequency 100 MHz is frequency modulated by sine wave of amplitude 20 volts and frequency 100 KHz. The frequency sensitivity of the modulation is 25 KHz per volt. Determine the approximate bandwidth of FM wave using Carson's rule.-------5 Marks

f_c = 100 MHz

frequency sensitivity = 25 kHz / V

E_m = 20 V

f_m = 100 kHz

δ = E_m × freq. sensitivity = 20 × 25 = 500 kHz

BW = 2 (δ + f_m) —— By Carson's Rule

= 2 [500 kHz + 100 kHz)

= 2 × 600 kHz

= 1200 kHz = 1.2 MHz

∴ BW = 1.2 MHz

Q4 -c) A 360 W carrier is simultaneously Amplitude modulated by two audio waves with modulation percentages of 55 and 65 respectively. What is the total sideband power?---------- - 5Marks

Given: P_c = 360 W

% m_1 = 55 ⇒ ∴ $m_1 = \frac{55}{100} = 0.55$

% m_2 = 65 ⇒ ∴ $m_2 = \frac{65}{100} = 0.65$

Effective modulation index $(m) = \sqrt{m_1^2 + m_2^2}$

$$m = \sqrt{(0.55)^2 + (0.65)^2}$$

$$m = 0.8515$$

Single sideband power $(P_{SSB}) = P_c \times \frac{m^2}{4}$

$$= 360 \times \frac{(0.8515)^2}{4} W$$

$$= 65.25 W$$

Double sideband power $(P_{DSB}) = 2 P_{SSB} = P_c \times \frac{m^2}{2}$

$$= 360 \times \frac{(0.8515)^2}{2} W$$

$$= 130.51 W$$