$\therefore B_{FM} = 2(\frac{1}{5}\cdot 25 + 1)\times 5 = 60kHz$.

(1). When $m_a = 1$, is full Am,
When $m_a > 1$, is over Am.

(2). $\because S(t) = 100\cos(w_c t + 25\cos w_m t)$.

$\because \beta_{FM} = \frac{k_p A_m}{w_m} = 25$.

$\because w_m' = 5w_m$

$\therefore \beta'_{FM} = \frac{k_p A_m}{5w_m} = \frac{1}{5}\beta_{FM} = 5$.

$\because B_{FM} = 2(\Delta w_{max} + w_m) = 2(\beta_{FM} + 1)w_m$.

$\because w_m' = 5w_m = 5kHz$.

$\therefore B_{FM} = 2(5+1)\cdot 5 = 60kHz$.

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(3). $\because$ The widen Bandwidth, stronger anti-noise.
$\therefore$ AM = DSB > VSB > SSB.

(4). $B_{AM} = 2f_H$

$B_{DSB} = 2f_H$

$B_{SSB} = f_H$

$f_H < B_{VSB} < 2f_H$.

(5) PM is ~~frequency~~ phase modulating.

$\Rightarrow c(t) = A\cos(w_c t + \varphi)$.

$\theta(t) = w_c t + \varphi(t)$

~~$w(t) = w_c t$~~

$\therefore S_{PM} = A\cos[w_c(t) + K_p f(t)]$

FM is frequency modulation, and FM is the derivative of phase.

$\theta(t) = w_c t + \varphi(t)$

$$\frac{d\theta'(t)}{dt} = w_c t) -$$

$$w(t) = w_c + \frac{d\varphi(t)}{dt}.$$

(b). 1.

$\because B_{FM} = 2(\beta_{FM}+1) f_m = 2(\Delta W_{max} + W_m)$

$= 2(10+40)$

$= 100\ kHz.$

2.

$\because \cancel{W_m = \frac{1}{3}}\ B_{FM} = 2(\beta_{FM}+1) W_m = 100 kHz.$

$\beta_{FM} = 0.25.$

$\because \beta_{FM} = \frac{k_p A_m}{W_m}$

$\therefore A'_m = \frac{1}{3} A_m$

$\therefore \beta'_{FM} = \frac{k_p A_m}{3W_m} = \frac{1}{12}.$

$\therefore B_{FM} = 2(1+\beta'_{FM}) \cdot W_m = 2(1+\frac{1}{12})40 \approx 86.7\ kHz.$

3. $\because W'_m = 2W_m = 80\ kHz.$

$\therefore B_{FM} = 2(\beta'_{FM}+1) W'_m$

$= 2(\frac{k_p A_m}{W'_m}+1) W'_m$

$= 2(k_p A_m + W'_m)$

$\because k_p A_m = \beta_{FM} \cdot W'_m = 0.25 \cdot 80 = 20.$

$\therefore B'_{FM} = 2(80+80) = 320\ kHz.$

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(7) $$G_{AM} = \frac{2\overline{m^2(t)}}{A_0^2 + m^2(t)}.$$