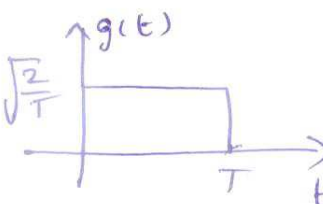
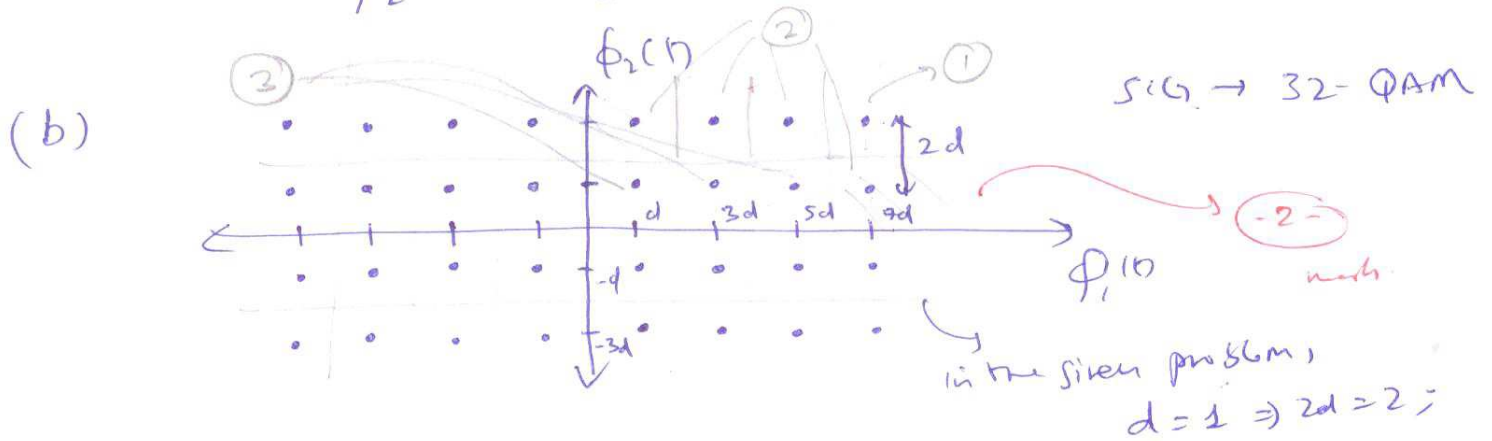


3. [1 + 2 + 2 + 4 = 9 marks]

$$S(t) = I_1(t) g(t) \cos 2\pi f_c t + I_2(t) g(t) \sin 2\pi f_c t$$

(a) since  $\int_0^T g^2(t) \cos^2 2\pi f_c t dt = 1$ (check!)

∴ $\phi_1(t) = g(t) \cos 2\pi f_c t$;
 & $\phi_2(t) = g(t) \sin 2\pi f_c t$; } -1- mark



(c) $E_a = \sum_{i=1}^{32} s_i^2 p_i = (58d^2 + 50d^2 + 34d^2 + 26d^2 + 18d^2 + 10d^2 + 10d^2 + 2d^2) \times \frac{4}{32}$

∴ $d = \sqrt{\frac{E_a}{26}}$ $E_a = 208d^2 \times \frac{1}{8} = 26d^2$
 $\Rightarrow E_a = 26 \times 1^2 = 26 \text{ Joules}$ -2- mark

(d) Type ① → 4 pts → $P_c = (1-q)^2 \Rightarrow P_{e1} = 1 - (1-q)^2$;
 Type ② → 16 pts → $P_c = (1-q)(1-2q) \Rightarrow P_{e2} = 1 - (1/2)(1-q)$;
 Type ③ → 12 pts → $P_c = (1-2q)^2 \Rightarrow P_{e3} = 1 - (1-2q)^2$;

Ans → $P(e) = \left[\frac{4}{32} P_{e1} + \frac{16}{32} P_{e2} + \frac{12}{32} P_{e3} \right]$ -4- marks