Question (4)

$$m(t) = \begin{cases} t+1 & 0 \le t \le 2 \\ 3 & 2 \le t \le 4 \\ -2t+11 & 4 \le t \le 5 \\ -1 & 5 \le t \le 6 \end{cases}$$

(a) $S(t) = A_c [1 + k_a m(t)] \cos \omega_c t$

$S(t) = A_c^2 [1 + (0.1t + 0.1)] \cos 2\pi 10^5 t$

$= 2 [1 + 0.1 * 3] \cos 2\pi 10^5 t$

$= 2 [1 - 0.1 * 2t + 0.1 * 11] \cos 2\pi 10^5 t$

$= 2 [1 - 0.1] \cos 2\pi 10^5 t$

Maximum

$|1 + k_a m(t)| > 0$

$|1 + k_a * 3| > 0$

$|k_a = \frac{1}{3}|$

(b) $A_c \cos(\omega_c t + k_p m(t))$

k_p = 0.1

(c) FM: $s(t)_{FM} = A_c \cos(\omega_c t + k_f \int m(t)\,dt)$

$\Delta f = k_f \max[m(t)]$

$k_f = \frac{300}{3} = 100$

d] $W = 10\ kHz$

AM: $2W = 20\ kHz$

DSBCC: $2W = 20\ kHz$

SSB: $W = 10\ kHz$

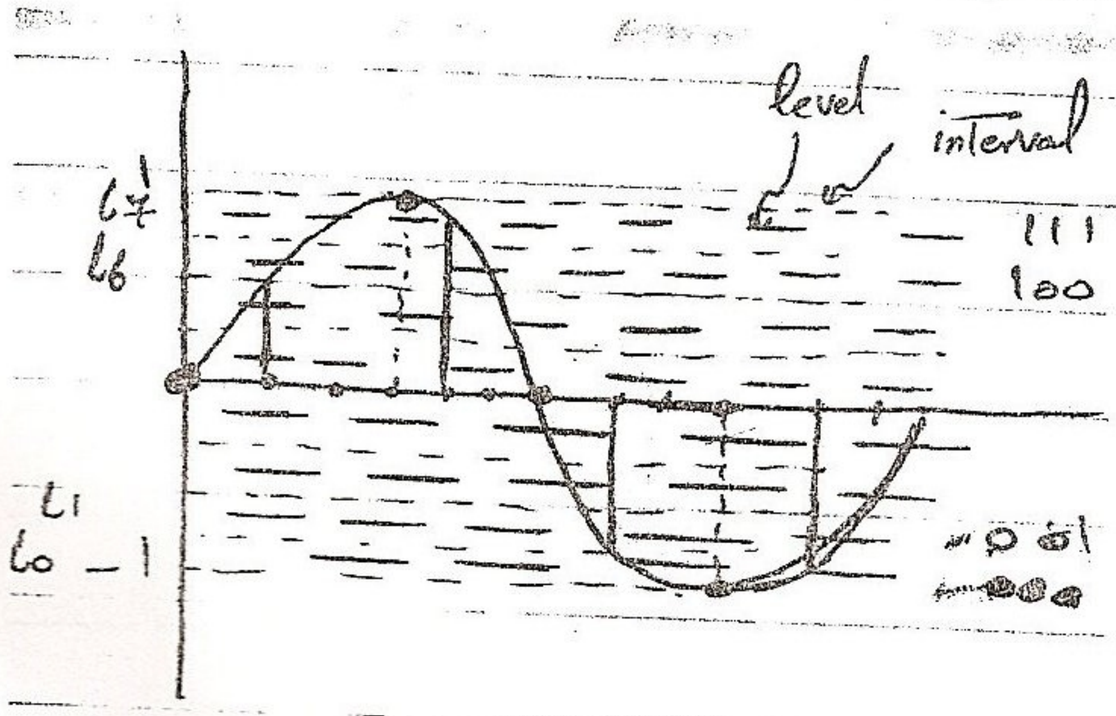
VSB: $1.25W = 12.5\ kHz$

FM: $2(\Delta f + f_m) = 20.6$

Q2]

a) $f_s = 4$ Sample / Cycle

$L = 2^3 = 8$ levels



$$\Delta = \frac{M_{max} - M_{min}}{8} = \frac{1}{4}$$

$W = 2\pi \quad f = 1$

b] { 110 111 001 000 } → at 1 cycle "output"

c] $f_s =$ 4 Sample / Cycle * no of cycles / sec

$= 4$ Sample / sec

R_s 3 bit / sample

$R_b =$ 12 bit / sec

BW - 6 Hz

d]

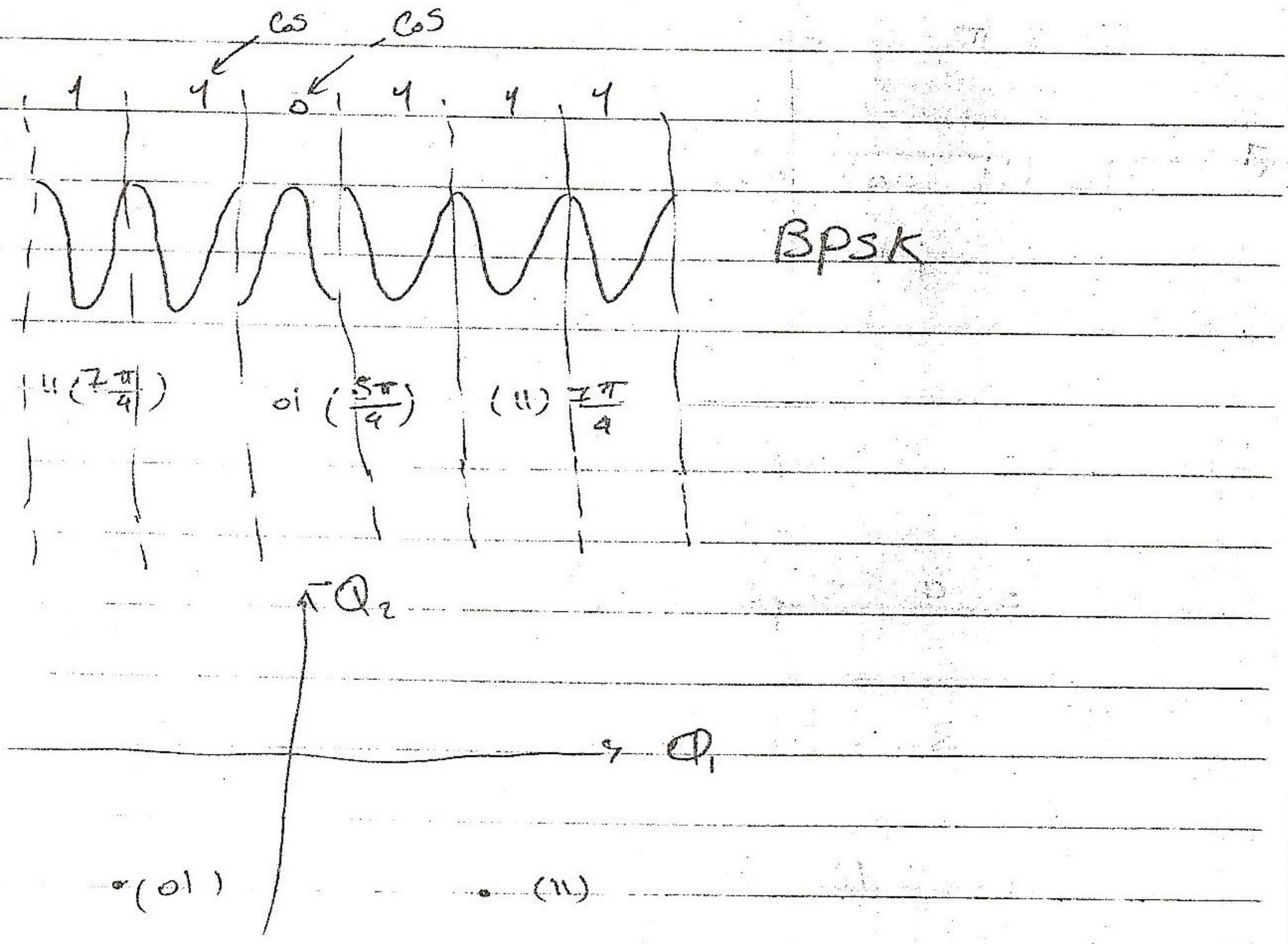
$BW = 2R_b$ → BPSK, BFSK, BASK

$\frac{BW}{M\text{-ary}} = \frac{2R_b}{\log_2 M}$

QPSK ⟹ $M = 4$

16-QAM ⟹ $M = 16$

e]



Q3]

W = 4 KHz

(a) $f_s = 2W = 8$ KHz

(b) $R_b = R f_s = 8 * 8 * 10^3 = 64000$

(d) $BW_{BPSK} = 2R_b$

C) $BW = W$ Nequist

e) $BW = W\left(1 + \frac{\alpha}{4}\right)$ α: 0.2

Part B.

[IV] λ = 4 Calls / min

t_m = 5 min A = 20 erlang

N = 25 line Get B from table

[III] A = 12 erlang t_m = 5 min

a- $\lambda = \frac{A}{t_m} = \frac{12}{5}$ Call / min

b- B = 0.5 % Friedman

c- $\frac{A}{n}$