~~From~~ the assigned words, $d_{min} = 7$. $R = K/N = \underline{\underline{16/31}}$.
and $N = 31$.

$K = 31 - 15 = 16$

<u>To find P(E).</u>

~~I.~~ <u>For soft decision.</u>

After ~~the~~ code extension, $R = 16/32 = 1/2$ and $d_{min} = 7+1 = 8$.

$$P(E) \approx Q\left(\sqrt{\frac{2E_b}{N_0} \cdot R\, d_{min}}\right) \quad \text{(in general.)}$$

???

$$= 155 Q\left(\sqrt{\frac{2E_b}{N_0} \cdot \frac{1}{2} \times 8}\right) + 465 Q\left(\sqrt{\frac{2E_b}{N_0} \cdot \frac{1}{2} \cdot 9}\right) + \ldots \qquad t = \left\lfloor \frac{d_{min}-1}{2} \right\rfloor = \frac{7-1}{2} = 3$$

<u>For Hard decision.</u>

~~P(E) ≈ Q(~~

$$P(E) = \sum_{h=t+1}^{N} \binom{N}{h} \varepsilon^h (1-\varepsilon)^{N-h}$$

$$= \underline{\underline{\sum_{4}^{32} \binom{N}{h} \varepsilon^h (1-\varepsilon)^{N-h}}}$$

Where $\varepsilon = Q\left(\sqrt{\frac{2E_b}{N_0} R d}\right)$ and $P(E) \approx Q\left(\sqrt{\frac{2E_b}{N_0} \cdot R(t+1)}\right)$

$$= \underline{\underline{Q\left(\sqrt{\frac{2E_b}{N_0} \cdot \frac{1}{2} \times (3+1)}\right)}}$$

(b) <u>To design (6,2) cyclic code.</u>

$N = 6$, $K = 2$.

Thus, $D^6 + 1 = (D+1)(D+1)(D^2+D+1)(D^2+D+1)$.

<u>There are 2 possible ways.</u>

(i) $(D+1)(D+1)(D^2+D+1) = (D^2 + \cancel{D} + \cancel{D} + 1)(D^2+D+1)$

$= D^4 + D^3 + \cancel{D^2} + \cancel{D^2} + D + 1 = \underline{\underline{D^4 + D^3 + D + 1}}$.

(ii) $(D^2+D+1)(D^2+D+1) = D^4 + \cancel{D^3} + \cancel{D^2} + \cancel{D^3} + \cancel{D^2} + \cancel{D} + D^2 + \cancel{D} + 1$.

$= \underline{\underline{D^4 + D^2 + 1}}$ is the shortest general polynomial.

$\Rightarrow$ # possible $= 2^2 = 4$, possible codewords.

0 0 0 0 0 0	
0 1 0 1 0 1	3
1 0 1 0 1 0	3
0 1 0 1 0 1	3

$d_{min} = 3$