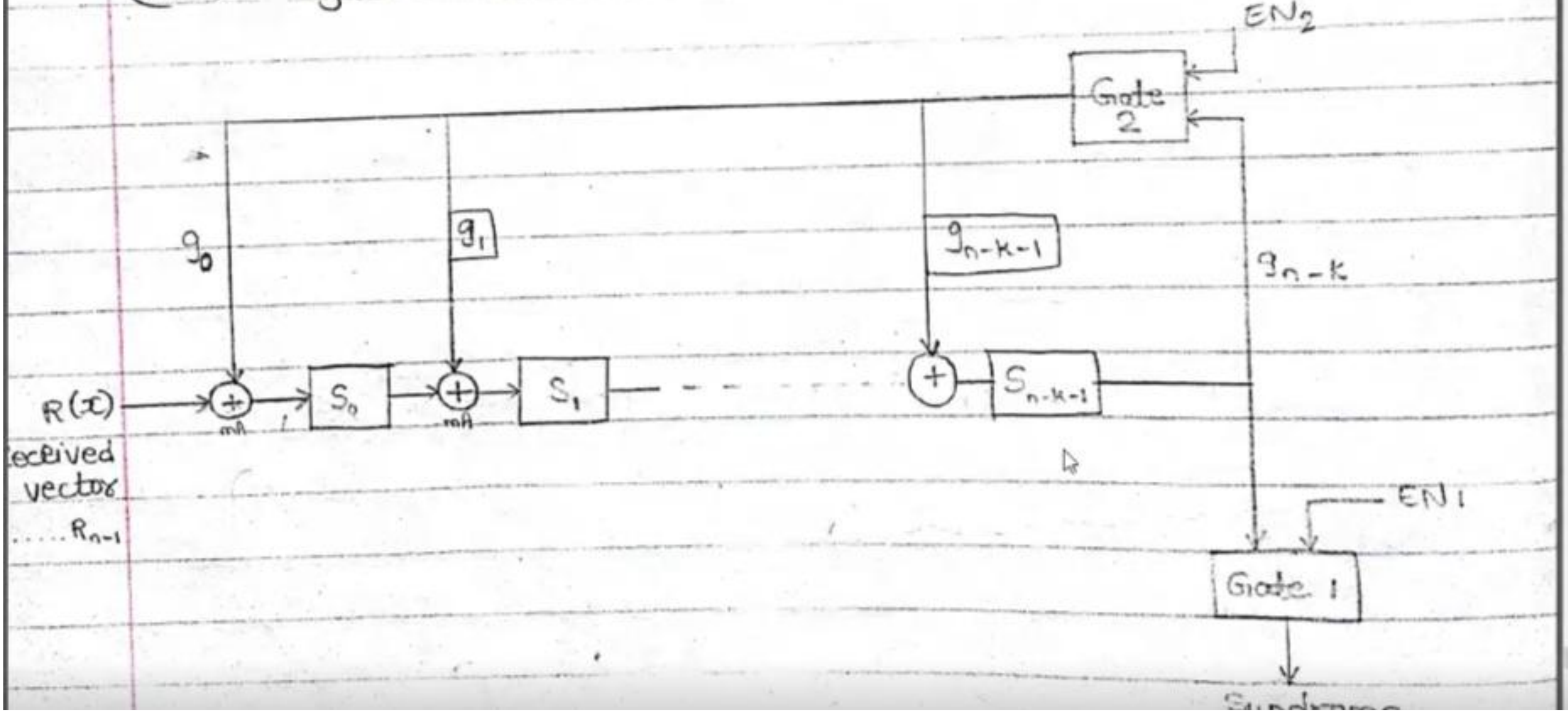
syndrome ... g... (n-k) cyclic code is shown below.



clock pulses, the flip-flops will have the co-efficients of syndrome polynomial. After the message is loaded into the shift register, gate 2 is turned OFF & gate 1 is turned ON and the information present in syndrome calculating circuit is shifted to an error detection & correction circuit.

P) For a (7,4) cyclic code, the received vector is 1110101 and the generator polynomial $g(x) = 1+x+x^3$. Draw the syndrome calculation circuit & correct the single error in the received vector.

$n-k = 7-4 = 3$ bit shift register

Indicates error

Consider $g(x) = 1+x+x^3$

It is known that $g(x)$, $x\,g(x)$, $x^2 g(x)$ & $x^3 g(x)$ also represent the code vector polynomial of the same cyclic code.

$$g(x) = 1101000$$
$$x.g(x) = 0110100$$
$$x^2.g(x) = 0011010$$
$$x^3.g(x) = 0001101$$

$$\therefore [G] = \left[\begin{array}{ccc|cccc} 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{array}\right]$$

$x \cdot g(x) = 0110100$

$x^2 \cdot g(x) = 0011010$

$x^3 \cdot g(x) = 0001101$

$$\therefore [G] = \left[\begin{array}{ccc:cccc} 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{array}\right]$$

Let $3^{rd}$ row $= 1^{st}$ row $+ 3^{rd}$ row

$$[G] = \left[\begin{array}{ccc:cccc} 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ \text{[illegible]} & \text{[illegible]} & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{array}\right]$$

Let $4^{th}$ row $= 1^{st}$ row $+ 2^{nd}$ row $+ 4^{th}$ row

$$\therefore\ [G] = \left[\begin{array}{ccc|cccc} 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ \bullet & \bullet & 1 & 0 & 0 & 1 & 0 \\ \bullet 1 & 0 & 1\bullet & 0 & 0 & 0 & 1 \end{array}\right]$$

$$\therefore\ [G] = \left[\begin{array}{ccc|cccc} 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 \end{array}\right.$$

Generally

$G = [I_K : P]$

$H = [P^T : I_{n-k}]$

$[H] = [I_{n-k} \vdots P^T]$

$$= \left[\begin{array}{ccc|cccc} 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 \end{array}\right]$$

$G = [P_{n-k} \vdots I_k]$

$H = [I_{n-k} \vdots P^T]$

$H^T = \begin{bmatrix} I_{n-k} \\ \hline P \end{bmatrix}$

$$[H^T] = \left[\begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ \hline 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{array}\right]$$

$\leftarrow$ Syndrome present in $3^{rd}$ row

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$R + E = C$

$$[H^T] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ \hline 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

$\leftarrow$ Syndrome present in $3^{rd}$ row

$R + E = C$

$\therefore$ Error pattern $= [0010000]$

$\therefore$ Corrected vector $= [1100101]$

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do for $R(x) = \underline{0111011}$

Syndrome $= 111$

A (15, 5) Algebraic code (cyclic) is generated using generator polynomial $g(x) = 1+x+x^2+x^4+x^5+x^8+x^{10}$

i) Draw block diagram of encoder

ii) Find code polynomial for message polynomial $d = 1+x^2+x^4$ using encoder diagram

$d = (10101)$ $g(x) = (11101100101)$

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tion 1