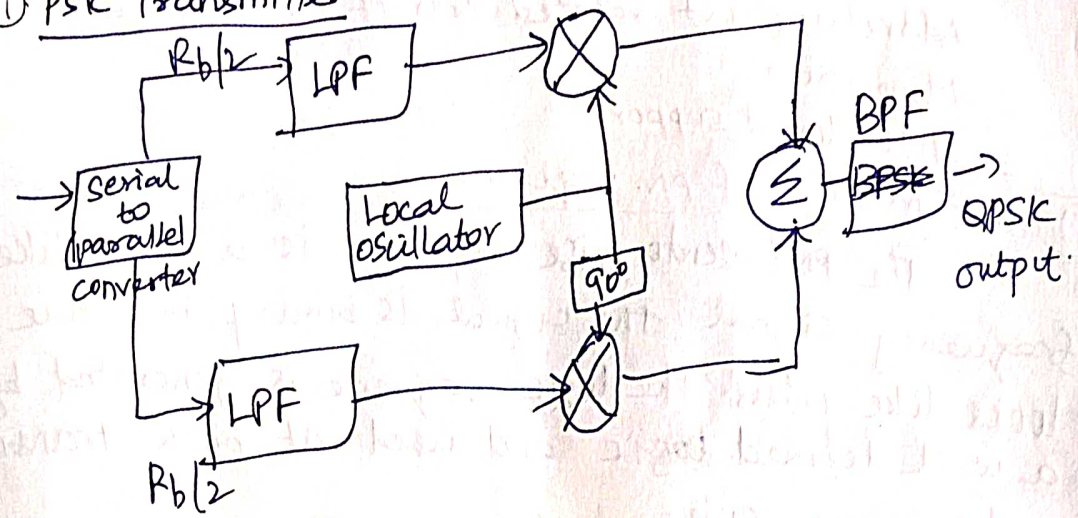
20ITT41 – Principles of communication

CAT – 3

Answer key

① PSK Transmitter



② Bandwidth efficiency

$$B = \frac{\text{Transmission bit rate}}{\text{minimum bandwidth}}$$

$$= \frac{24000}{8000}$$

$$= 3 \text{ bits per second per cycle of bandwidth.}$$

Bandwidth $= B = \frac{24000}{3}$

$= 8000 Hz$

③ Various error detection methods

* Vertical Redundancy check (VRC)
* Longitudinal Redundancy check (LRC)
* check sum
* Cyclic Redundancy check (CRC).

④ For character 'S'

ASCII value $= 53_H$

$= 0101\ 0011$

odd parity bit = 1

even parity bit = 0.

⑤ RS232

	RS232	RS485
Max cable length:	50Ft	4000ft.
Data rate :	460kb/s	30Mb/s.
Max. driver output voltage	±25V	−7 to +12V
Driver output signal level	±25V	±6V
Load impedance:	3k to 7k	54k.

(6) Objectives of ISDN communication

- System standardization
- Achieving transparency
- Seperating function
- variety of configuration
- Addressing cost related tariff.
- Migration
- Multiplexed support.

(7) Significance of PN sequence.

The PN (pseudo noise sequence is a noise like high frequency signal. The signal is binary in nature and looks like pulses. The logic sequence is generated by a well defined logic and used at both transmitters and receiver side.

(8) Types of FHSS.

(i) Slow frequency hopping
(ii) Fast frequency hopping.

(9) Processing gain

$$P.G = \frac{T_b}{T_c}$$

$$= \frac{4.095 \times 10^{-3}}{1 \times 10^{-6}} = 4.095 \times 10^{3} = 4095$$

(10) Slow Frequency hopping: Multiple symbols are transmitted in one frequency hop. Hop rate is lower than symbol rate.

Fast frequency hopping: Multiple hops are taken to transmit one symbol. Hop rate is higher than symbol rate.

PART-B

(11) problem

$C = 10^{-8}$ W $N = 2.5 \times 10^{-10}$ W, $f_b = 240$ kbps, $B = 80$ kHz

(i) noise power density

$$N_o(dBm) = N_{in}\ dBm - 10 \log B.$$

$$N_{in}\ dB = \frac{10 \log (2.5 \times 10^{-10})}{0.001} = 10 \log (80 \times 10^{+3})$$

$$= -68.02 - 49.03 = -115\ dB$$

(ii) Energy per bit

$$E_b = 10 \log \frac{C}{f_b}$$

$$= 10 \log \left(\frac{10^{-8}}{240 \times 10^3} \right)$$

$$= -133 \text{ dBJ}.$$

(iii) Energy per bit to noise density ratio

$$\frac{E_b}{N_0} = 10 \log \frac{C}{N} + 10 \log \frac{B}{f_b}$$

$$= \left(10 \log \frac{10^{-8}}{2.5 \times 10^{-10}} \right) + 10 \log \left(\frac{8 \times 10^{7/3}}{240 \times 10^3} \right)$$

$$= 16.02 - 4.77$$

$$= 11.25 \text{ dB}$$

(iv) Carrier to noise density ratio.

$$= 10 \log \frac{C}{N}$$

$$= 16.02 \text{ dB}.$$

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(12) BAR CODE

- Black and white striped stickers.

→ Discrete code & continuous code, 2D code.

CODE 39 – Code 39 bar codes are ideally suited for making labels, such as name badges.

- contains 9 vertical elements, [5 bars & 4 spaces]
- Three of 9 elements must be logic 1, rest must be logic 0.
- All characters are seperated with intercharacter gap.

UPC – Universal Product code – continuous code, there is no intercharacter spaces. Each label contains 12-digit number.

- Start guard pattern
- Stop guard pattern.
- centre guard pattern – consists of 2 long bars
- The first left hand digit – identifies how the UPC symbol is used.

(13) i) CRC

$G(x) = x^7 + x^4 + x^2 + x^0 = 10010101$

$P(x) = x^5 + x^4 + x^1 + x^0 = 110011$

```
      111
110011 | 10010101
       | 110011
       ---------
       | 0101100
       |  110011
       ---------
       | 00111111
       |   110011
       ---------
       |  001100  = CRC.
```

ii) Hamming code

$B = 42_H = 0100\ 0010.$

$m = 8$ 7.

$2^n \geq m+n+1$

n = Hamming bits

$n = 4$

12	11	10	9	8	7	6	5	4	3	2	1	0	bit position.
H	H	H	1	0	0	0	H	0	H	1	0		

Bit position. Binary

with 1's: 9 = 1001

0001

1000 Hamming bit.

(14) DSSS

- Direct sequence spread spectrum
- PN sequence is used to modulate.
- Transmitted BW >> information BW
- XOR technique.
- PN code generated at transmitter, known by receiver.