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Radar and Satellite Communication

Q.1

a. Explain BPSK and QPSK with the help of phase diagram?

Ans

BPSK

- It is possible to group several bits of information as a symbol
- When combining N information bits there is the possibility of $M = 2^N$ states
- When $N = 1$, $M = 2$
  m takes value of 0 and 1
  $\theta m = \pi/2$ and $3\pi/2$
- Carrier phase is changed by 180° for each bit. this is BPSK.

QPSK

- When two bits are combined as a symbol, there are 4 possible phase states corresponding to:
  0°, 90°, 180° and 270°
- this is known as QPSK (Q is for Quadrature)
- In general, when N baseband bits are combined to give M carrier states, such a scheme is known as M-ary PSK.

b. what is 40 dBm in W?

Ans convert 40 dbm into watt

$$P(\text{watt}) = \frac{10^{\frac{40}{10}}}{1000} = 10 \text{ watt}$$

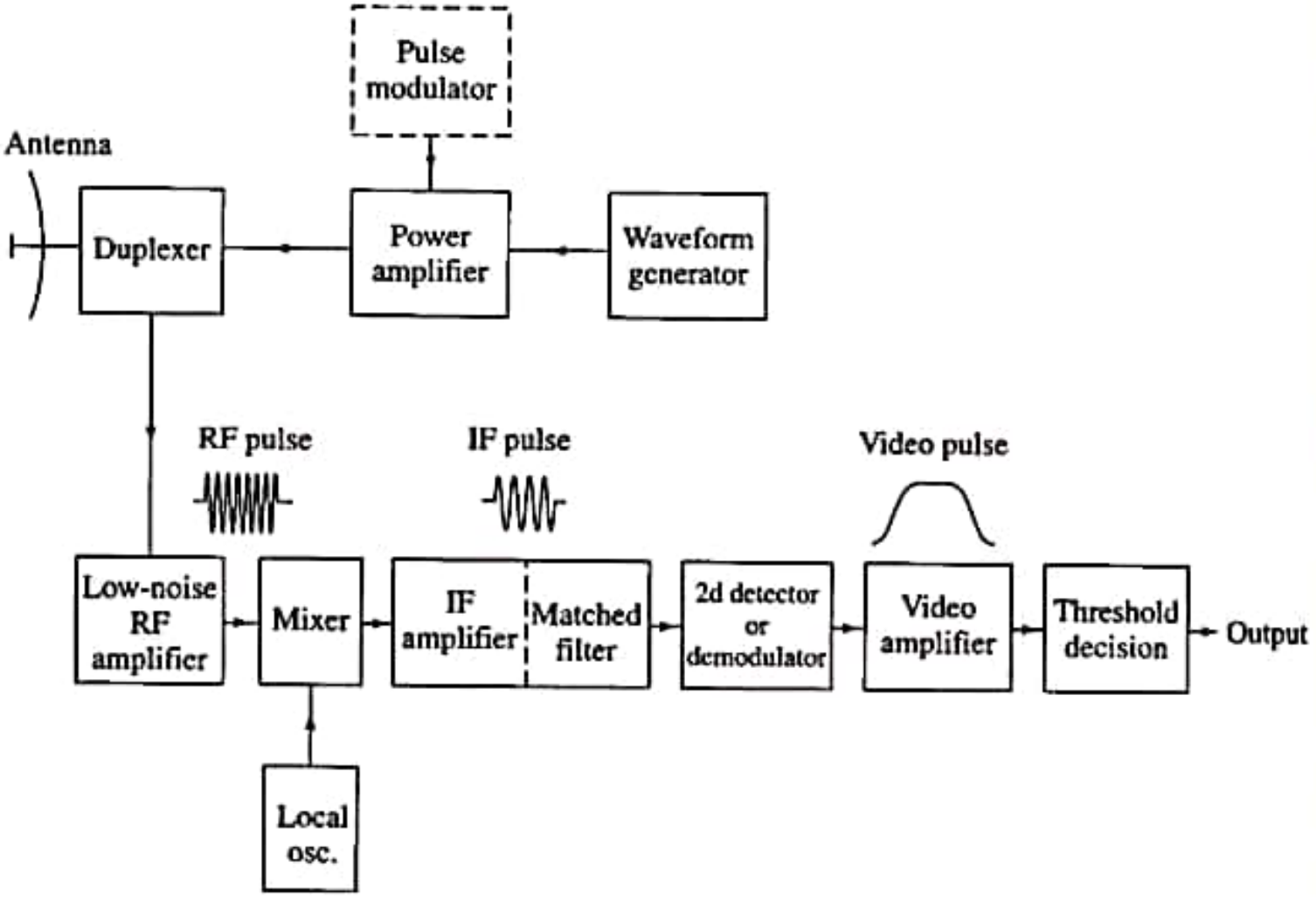
Q.2

a. Draw and Explain Radar Block Diagram.

Ans Explanation:-

The block diagram of a simple radar system is shown in Figure. this block diagram indicates that the radar system consists of both the transmitting and the receiving system.

This connects the antenna to the transmitter during transmission and to the receiver during reception.



b) Name & explain the type of block coding and Polarization used in mobile satellite communication?

Answer:-) • Hamming codes
- Minimum distance of 3
• BCH
- Most powerful of all codes.
• Reed-solomon (RS)
- Used for correcting bursty errors in mobile satellite communication.
• Golay M
- minimum distance of 7.
• Code selection is dependent generally on channel characteristics.

Q3 a) Find out the orbital speed & time period of satellite?

Ans:- a) Time Period of a satellite.

Distance covered by the satellite in 1 revolution.

= circumference of the circle.

Time taken to cover this distance is the time period.

Critical speed $V_c = \frac{\text{Circumference}}{\text{Periodic time}}$

$V_c = \frac{2\pi r}{T}$

But $V_c = \sqrt{\frac{G_m}{r}}$

$\sqrt{\frac{G_m}{r}} = \frac{2\pi r}{T}$

$\frac{G_m}{r} = 4\pi^2 r^2 \frac{r}{T^2}$

$T^2 = \frac{4\pi^2 r^3}{G_m}$

As $\frac{4\pi^2}{G_m}$ is a constant

So we get

$T^2 \propto r^3$

$T = 2\pi\sqrt{\frac{r^3}{G_m}}$

orbital speed

- orbital speed of a satellite is the minimum speed required to put the satellite into a given orbit around earth

Q3 a)

- Expression = $-V_0 = \sqrt{(R_c \cdot g)}$ where $g = 9.8 m/s^2$ and R_c = radius of earth. The value for orbital velocity was found to 7.9 km/s

$$V = \sqrt{\frac{Gm}{R}} = \sqrt{\frac{gR^2}{R}}$$

- it is independent of mass of satellite
- Decrease with an increase in the radius in the height of satellite

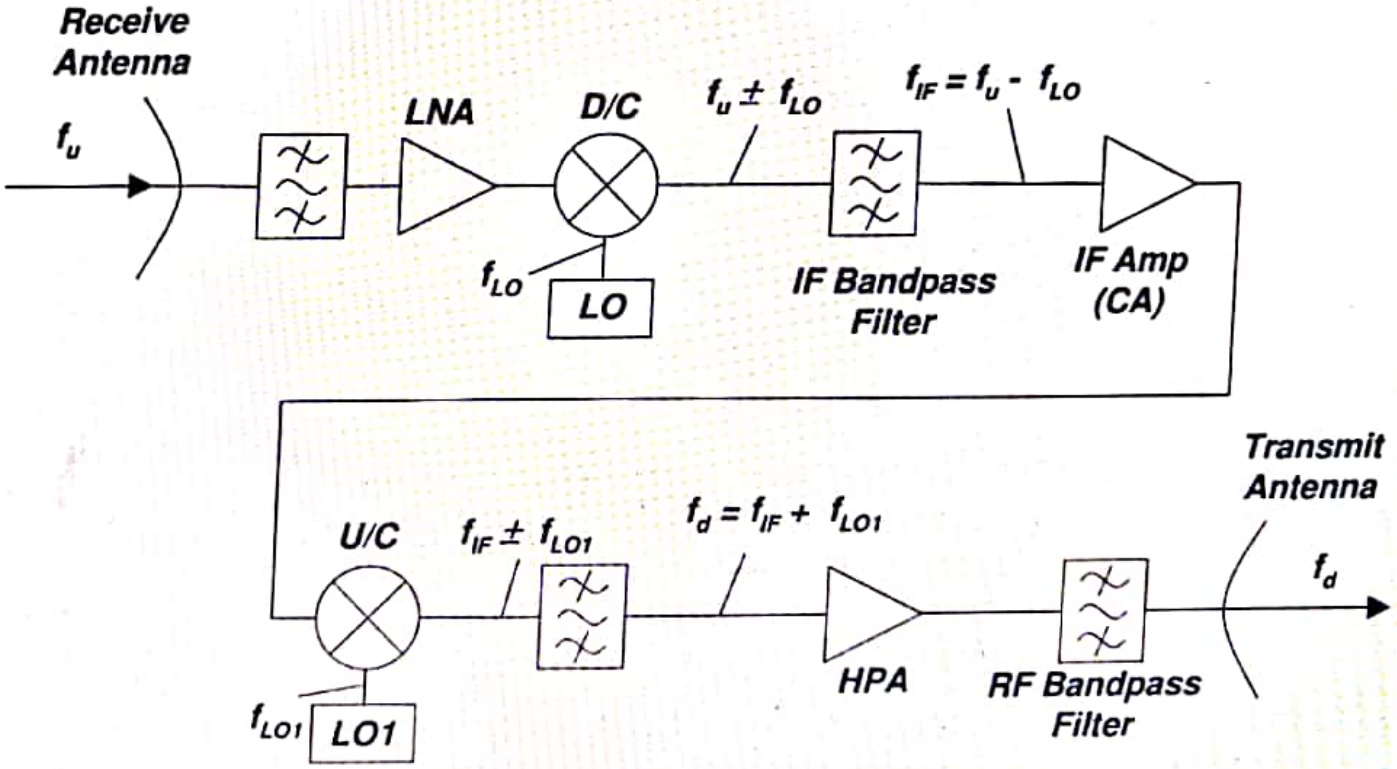
Q4) Explain double conversion transparent transponder?

Ans:- • Used in mobile communication system satellite to convert from one band to another.
- ACeS uses L-band (1.6/1.5 GHz) for mobile links and C-band (6/4 GHz) for feeder link.
- Convenient for interconnection of Ku-band Payload (14/12 GHz) and C-band (6/4 GHz)

Transparent Transponder Overview

- Translates the uplink frequency to a suitable downlink frequency and power.
- operate irrespective of access and modulation scheme used by system.
- Baseband signal is not recovered.
- No digital processing can be applied to signal.

Double Conversion – Basic Components



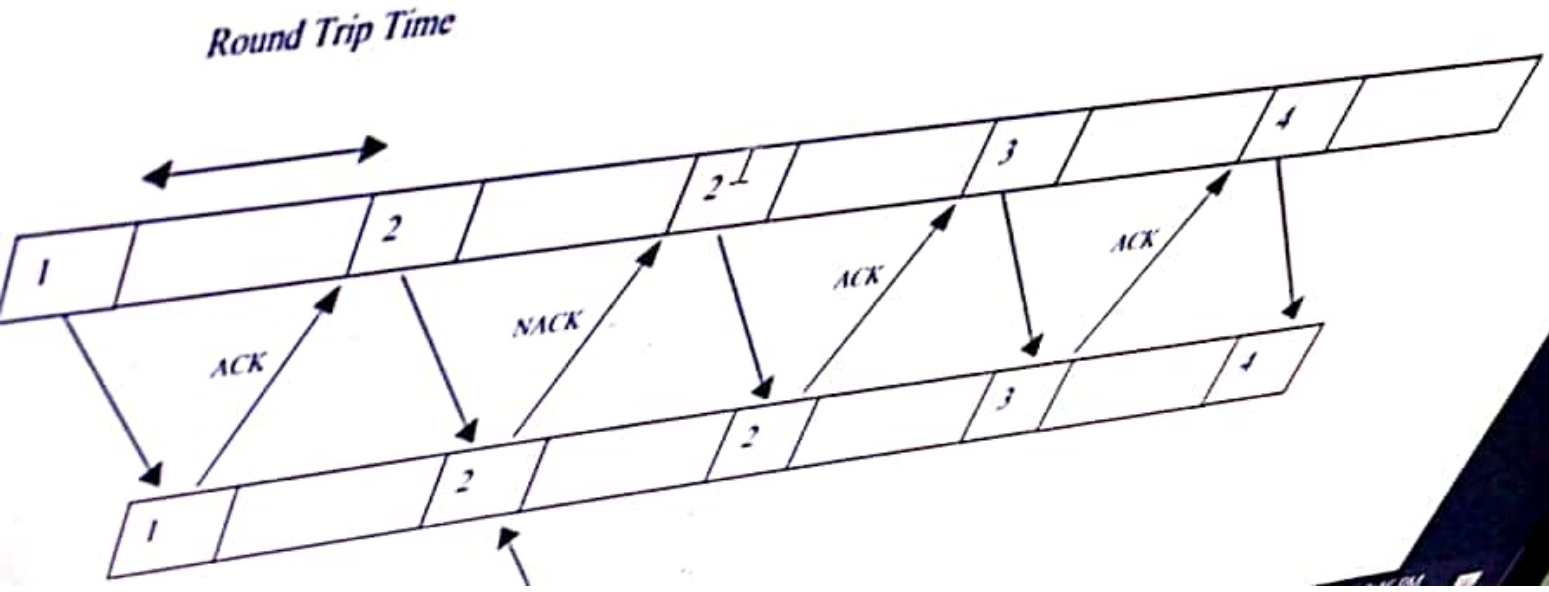
Double Conversion Transparent Transponder

Q.5 Draw a diagram to illustrate the Application of the ARQ schemes.

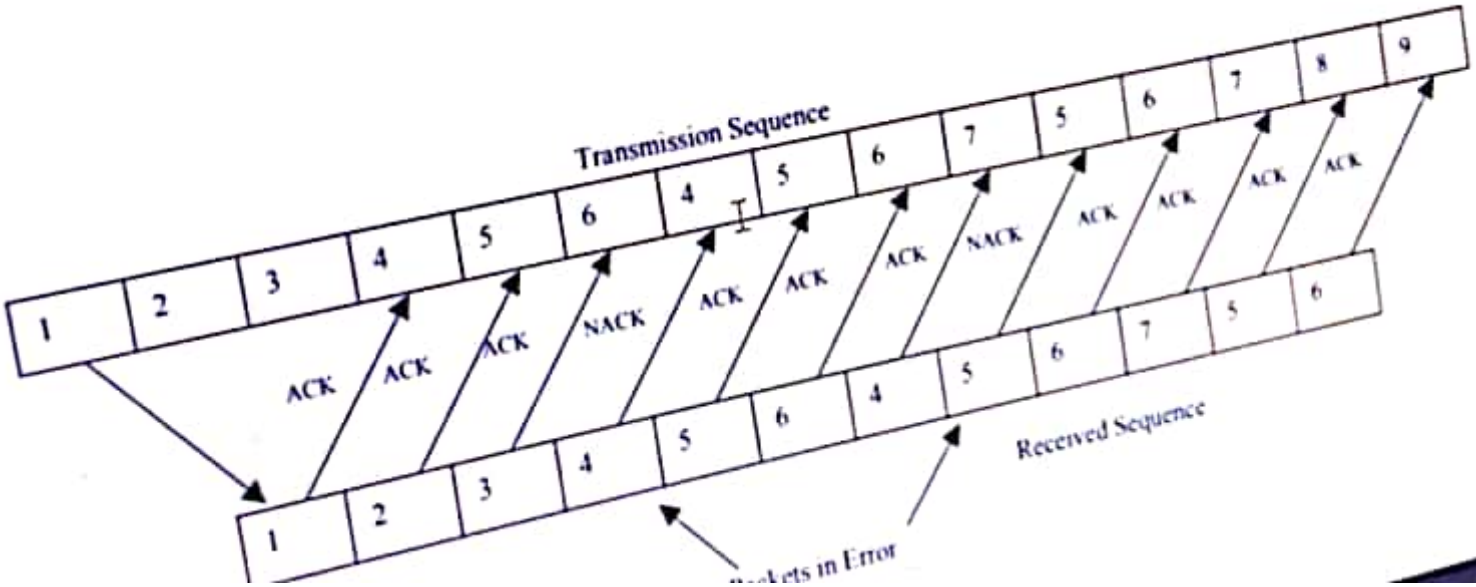
Ans:- Three classes of ARQ

- stop and wait
- continuous ARQ
- continuous ARQ with selected repeat

Stop and Wait



Continuous ARQ with repeat



dra diagram to illustrate the app

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Continuous ARQ with selected repeat