# Assignment

Q1) Given;

Size of file = 100 KB

Length of Cable b/w Source & router = 1000 km

" " " " router to Destination = 1500 km

Signal speed = 200,000 km/S

Data Rate = 1000k bps

Transmission delay = $\frac{\text{Size of file}}{\text{Data rate}}$ = $\frac{100\text{kB} \times 8 \text{bits/kB}}{1000 \text{kbps}}$ = 0.8 S

Propogation delay$_1$ = $\frac{1000\text{km}}{200{,}000\text{km/S}}$ = 0.005 S = 5 ms

Propogation delay$_2$ = $\frac{1500\text{km}}{200{,}000\text{km/S}}$ = 0.0075 S = 7.5 ms

Total time = 0.8s + 5ms + 7.5 ms = 0.8 S + 12.5ms = 0.8125 S

A2. Frequency division multiplexity allocates separate frequency band to each channel since each voice channel has special components up to 4KHZ, we need to allocate non-overlapping frequency bands so 10 voice channels, the Carrier frequency would be 0KHZ, 4KHZ . . . ,
The overall bandwidth required would be sum of bandwidth is 10×4KHz = 40 KHZ

3) NRZ-L →

NRZ-I →

RZ →

manchestoo →

Differential manchestor →

4) Given the signal frequencies b/w 300 to 330 kHZ and signal to noise ratio of 496 Harthley theorem

$(3300-300) \times \log(1+4096)B$

$3000 \times 12\ B$

$= 36000$ bps

5) Given bandwidth for one TV is 6MHz for 128 QAM and no of symbol is 128 Band rate can be Calc. as

$2\log 2 = 2 \times 6MHz \log 2(128)$

$= \log_2(128) \times 6Hz$

$= 1.71 \times 1.86$

$= 1.71 \times 106$ band.

rate is Calculated by $= 11.97 \times 106$ bps

$=$ ~~Er~~

7)

Since there are 16 points on two Concentric Circle a 16 QAM scheme should be suitable

Baand Rate = Date rate log 2(Band Rate).

$= \log 2(m) \times$ Data rate.

$= 64 \times 103$ bps $\log 2$

$= 64 \times 103$ bps $\times$ Band rate

$= 463 \times 103$ bps $= 43689$ bps

8) For FDM

Allocate frequency from 0 to 4 kHZ , 4 to 8 kHZ , - - -
36-40 kHZ for each channel

The overall bandwidth required would be 10×4 kHz = 40 kHZ

For TDM

- Each voice channel has b/w of 4 kHZ each slot needs to accomodate 4 kHZ

- Eneith 10 channel the frame duration is 10×18000 = 1.25 ms

- The total frame rate is 11.25 ms = 800 frame per sec × 1.25 ms
  = 1800 per sec

The rate of TDM is $100 \times 4\text{kHz} \log_2 (256)$
$= 400 \text{kHz} \log_2 (256)$

9) Time Division multiplexing can be used where each channel get a time slot since the data rate of each channel is 100 mbps and there are 4 channels the total data rate is 4 × 100 mbps = 400 mbps which fits with bandwidth of 5 mHz.

10) $\text{Transmission time} = \dfrac{\text{file size}}{\text{Data rate}}$

$= 1\text{MB} / 10 \text{mbps} = 0.1\text{S}$

Total delay = 7 ms
propagation delay = 15000 km × 540/km
= 75 ms

overall delivery time = $0.1 \times 0.0075 + 0.0758$

= $0.182 \times 0.15 + 0.075$

= $\underline{0.1828}$

11) Spatial resolution = 0.002 mbs

Image size = $10 \times 12m$

Each pack coded = 24 bit

Twisted pair = $10 \times 500 \times 12 \times 500 \times 25/100 \times 106$ S

Coaxial cable = $10 \times 500 \times 12 \times 50 \times \frac{24}{100} \times 106$ s

optical fiber = $10 \times 500 \times 12 \times 500 \times \frac{24}{100} \times 106$ s

12) Size of output frame = $25(4+1) = 125$ bits

output frame rate = 25 frame per slots

Duration of an output frame. 1 slot time

Output data rate = $125 \times$ frame rate $125 \times$ frame rate per sec

Effective utilization → If all channel have data for transmission utilization is 100%

6) a) max quantization error

- with step size of 0.5V
amplitude range from −5V to 5V.

Max quantisation error = $\frac{\text{step size}}{2} = 0.25V$

b) Data rate for encoding the voice channel

ⓐ with error detection (even parity check scheme)

, Data rate for each voice channel will be $(1+1)$ bit/Sample

Considering a sampling rate of 2 times the max freq (Nyquist theorem) the data rate for encoding voice channel will be $2 \times 3.5 kHz = 7$ kbps

ⓑ without error detection

Data rate will be 1 bit/Sample

Data rate for encoding the voice channel without error detection will be $3.5 kHz = 3.5$ kbps

c) output sync (TDM frame length)

Each frame consist of 30 frame will be $(30 \times (1+1)) = 60$ bits

Since each frame has 2 bytes of control information frame length will be $2 \times 8$ bit longer than data length total 76 bits

d) No. of bits in output sync - TDM frame

= TDM frame bits = 76 bits

e) output data rate of sync = TDM

Each frame is transmitted every 30 samples, each sample is encoded with, 2 bit

output data rate of sync TDM will be $= \frac{30}{1} \times 60$ kbps

$= 1800$ kbps

f) Effective channel utilization

If all channels has enough data for transmission, the effective channel utilization = 100%.

g) Channel utilization with 40% channels having no data

(i) For sync TDM → allocates fixed slots, so the channel utilisation will be 100%.

(ii) For statistical TDM - with 40% of channels having no data the effective channel utilisation will be reduced to

= 60% (100 - 40)