**Modulation and Coding**

1. A co-axial cable has a bandwidth of 1000 MHz. The cable is to be used in a Frequency Division Multiplexing system to carry simultaneous music channels. The base bandwidth for the music has been restricted to 15 kHz, how many music channels can the cable support?

1000MhZ/15 kHz = 6666.6

1. A fibre optic cable can carry 450 independent channels, each using a different wavelength of light - Wavelength Division Multiplexing (WDM). Each channel can support 200 Gbps. A single telephone connection requires 64 kbps. How many simultaneous telephone connections can the cable carry?

200Gbps divided by 64 kbps \*450 = 1406250000

1. A radio station transmitting on 12095 kHz using Full AM, has it's base bandwidth restricted to 7 kHz.
   1. What is the transmission bandwidth?

14kHz

* 1. What is the lowest radio frequency transmitted?

12088kHz

* 1. What is the highest radio frequency transmitted?

1302kHz

1. A file of 10,000 characters is to be sent over a 2,400 bps transmission line. Calculate the percentage overhead and the time taken to send the file over the line using asynchronous transmission with 8 bit ASCII coding, 1 start bit, 1.5 stop bits and 1 parity bit.

10,000\*11.5/2400 = 47.976%

1. The Baud rate of a communication channel with 8 signalling states is 120 Bd. What is the bit rate?

120\*8 = 960

1. A communication channel has a capacity of 2400 Bd. The throughput of the system is required to be 12000 bps. How many signalling states are required?

12000/2400=5

**Quantization and Noise**

1. The bandwidth of a music system has been measured and found to be 20 kHz. What is the Nyquist frequency?

40

1. What is the data rate of a sampled analogue signal which has a bandwidth of 50 kHz and uses 8 bit quantization?

2\*8\*50000 = 800KBPS

1. An analogue signal has a 15 kHz bandwidth, and is quantized into 32 levels. What is the data rate of the system?
2. What is the bandwidth of the analogue signal that has been sampled quantized into 65,536 levels and has a data rate of 100 kbps
3. A sharp spike of energy of 0.01 s duration appears in a line transmitting digital data with the rate of 2400 bps. How many ASCII characters could be affected?
4. A telephone line has an input power of 120 mW and an output power of 45 mW. What is the loss of the line in dB?

10log(45/120 = -4dB

1. Calculate the maximum capacity C, in bps for a transmission channel with a bandwidth of 10 kHz and a signal to noise ratio of 1000

99672.26259 99.67kbps

1. Calculate the maximum capacity C, in bps for a transmission channel with a bandwidth of 500 Hz and a signal to noise ratio of 10 dB

17.29bps

1. Data is to be transmitted over a LAN at 100 Mbps. Measurements on the system show that the S/N ratio is 90 dB. Calculate the Bandwidth required to transmit the data at the required rate.
2. The maximum through put on a digital radio channel of 5 kHz bandwidth is found to be 7 kbps. Calculate the signal to noise ratio in dB.