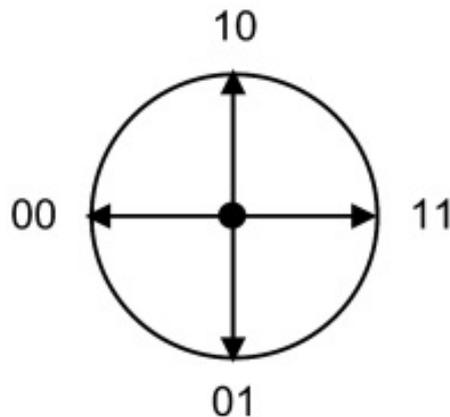


1. The following constellation diagram can be referred to:



DPSK

QPSK

AMI

BPSK

VDMT

OFDM

2. Choose three conditions that could be necessary for the coexistence of more modulations operating in common physical layer (i.e. one optical fibre) of an optical network:

1. _____
2. _____
3. _____

Optical channel interleaving, returning of optical symbols to zero, Semiconductor Optical Amplifiers, introduction of a safety bands splitting the systems, avoidance of crosstalk from intensity to phase modulation, avoidance of crosstalk from phase to intensity modulation, zero chromatic dispersion, improved synchronization, increasing the spectral efficiency by replacing CWDM by DWDM



3. Fill the numbers of correct statements concerning OFDM modulation:

- 1 – It is a multicarrier modulation
 - 2 – Optical symbols are transmitted using more frequencies
 - 3 – Optical symbols are transmitted using one frequency
 - 4 – It is an intensity modulation format
 - 5 – There are OFDM channels that are orthogonal
 - 6 – Sub-carriers are modulated using conventional modulation, e.g. PSK
 - 7 – Sub-carriers are modulated using VDMT symbols
 - 8 – Convolution codes can be used to increase errorless reception
 - 9 – It is used in LTE
 - 10 – It is used in DVB-T
 - 11 – It is used to encode data in MP3 format
-



4. Modify the following texts so that the statements referring to (V)DMT are true.

Discrete Multi-Tone (DMT) is a $\left(\begin{array}{l} \text{multicarrier} \\ \text{single carrier} \end{array} \right)$ modulation. Sub-channels widely use PSK or QAM, $\left(\begin{array}{l} \text{similarly} \\ \text{on the contrary} \end{array} \right)$ to OFDM.

DMT $\left(\begin{array}{l} \text{allows} \\ \text{does not allow} \end{array} \right)$ using different modulation schemes or even modulation types in each sub-channel of orthogonal multiplex.

In DSLAM there is information about all the symbols to be sent to the metallic line (there is a vector of the $\left(\begin{array}{l} \text{DMT} \\ \text{PSK} \\ \text{QAM} \end{array} \right)$ symbols).

In DSLAM, there $\left(\begin{array}{l} \text{is} \\ \text{is no} \end{array} \right)$ information about the parameters of particular symmetric pairs and crosstalk relations between them.

Synchronisation of all DMT symbols $\left(\begin{array}{l} \text{is} \\ \text{is not} \end{array} \right)$ necessary.

VDMT eliminates $\left(\begin{array}{l} \text{Far End Crosstalk} \\ \text{Near End Crosstalk} \end{array} \right)$.



5. Modulate the following binary data using BPSK, DPSK, QPSK and DQPSK modulation.

The data is 01001110. Example:

Bit value	0		1	
Laser	ON/OFF	Phase/ phase shift	ON/OFF	Phase/ phase shift
BPSK	ON	90°	ON	0°
DPSK	ON	-	ON	+90°

Bit value	0		1		0		0	
Laser	ON/OFF	Phase/ phase shift	ON/OFF	Phase/ phase shift	ON/OFF F	Phase/ phase shift	ON/OFF F	Phase/ phase shift
BPSK								
DPSK								

Bit value	1		1		1		0	
Laser	ON/OFF	Phase/ phase shift	ON/OFF	Phase/ phase shift	ON/OFF F	Phase/ phase shift	ON/OFF F	Phase/ phase shift
BPSK								
DPSK								

Bit value	01		00		11		10	
Laser	ON/OFF	Phase/ phase shift	ON/OFF	Phase/ phase shift	ON/OFF F	Phase/ phase shift	ON/OFF F	Phase/ phase shift
QPSK								