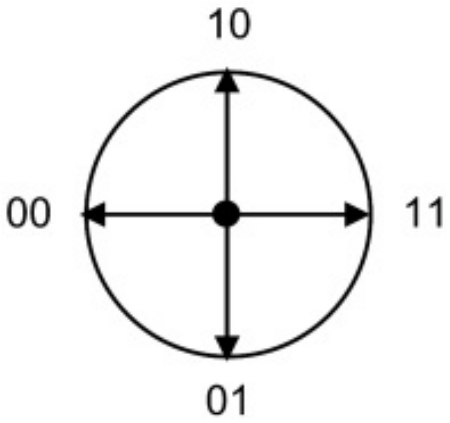
1. The following constellation diagram can be referred to:



DPSK ☐	**QPSK X**	AMI ☐
BPSK ☐	VDMT ☐	OFDM ☐

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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. **Optical channel interleaving**
2. **Introduction of a safety bands splitting the systems**
3. **Avoidance of crosstalk from intensity to phase modulation**

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~~

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

1
2
5
6
8
9
10

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

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

Discrete Multi-Tone (DMT) is a (multicarrier / ~~single carrier~~) modulation. Sub-channels widely use PSK or QAM, (similarly / ~~on the contrary~~) to OFDM.

DMT (allows / ~~does not allow~~) 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 (DMT / ~~PSK~~ / ~~QAM~~) symbols .

In DSLAM, there (is / ~~is no~~) information about the parameters of particular symmetric pairs and crosstalk relations between them.

Synchronisation of all DMT symbols (is / ~~is not~~) necessary.

VDMT eliminates (Far End Crosstalk / ~~Near End Crosstalk~~).

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5. Modulate the following binary data using BPSK, DPSK and QPSK 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	Phase/ phase shift	ON/OFF	Phase/ phase shift
BPSK	ON	90°	ON	0°	ON	90°	ON	90°
DPSK	ON	-	ON	+90°	ON	-	ON	-

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

Bit value	01		00		11		10	
Laser	ON/OFF	Phase/ phase shift	ON/OFF	Phase/ phase shift	ON/OFF	Phase/ phase shift	ON/OFF	Phase/ phase shift
QPSK	ON	145°	ON	45°	ON	225°	ON	315°

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