1. The following constellation diagram can be referred to:



BPSK

□

DPSK

□

**QPSK**

**x**

VDMT

□

AMI

□

OFDM

□

1. 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. I**ntroduction 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~~**

1. 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

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

Discrete Multi-Tone (DMT) is a modulation. Sub-channels widely use PSK or QAM, to OFDM.

DMT 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 symbols .

In DSLAM, there information about the parameters of particular symmetric pairs and crosstalk relations between them.

Synchronisation of all DMT symbols necessary.

VDMT eliminates .

1. 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° |