1. The following constellation diagram can be referred to:



BPSK

□

DPSK

□

QPSK

□

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. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**

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

|  |
| --- |
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|  |
|  |

**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, 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 | Phase/  phase shift | ON/OFF | Phase/  phase shift |
| BPSK |  |  |  |  |  |  |  |  |
| DPSK |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |  |  |  |  |  |  |  |  |
| DPSK |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |  |  |  |  |  |  |  |  |