Lecture -3

Part -1 Choose the correct answers:

1) Modulation is the process of converting:
    i) Digital data in electronic form to an optical signal that can be transmitted over the fiber.
    ii) Digital data in optical form to an electronic signal that can be transmitted over the fiber.
    iii) None of these.
2) demodulation process is the process of converting:
    i) The optical signal back into electronic form and extracting the data that was transmitted.
    ii) The electronic signal back into optical form and extracting the data that was transmitted.
    iii) None of these.
3) The most common signal formats are:
    i) Non-return-to-zero (NRZ).
    ii) Return-to-zero (RZ).
    iii) None of these.
4) In the NRZ format, the pulse for a 1 bit occupies the entire bit interval, and no pulse is used for a 0 bit:
    i) If there are two successive 1s, the pulse occupies two successive bit intervals.
    ii) If there are two successive 1s, the pulse does not occupies two successive bit intervals.
    iii) If there are two successive 1s, the pulse occupies all ones and zeros bits successive bit intervals.
5) In the RZ format, the pulse for a 1 bit occupies:
    i) Only a fraction of the bit interval, and no pulse is used for a 0 bit.
    ii) The fraction of the bit interval, and also done for pulse is used for a 0 bit.
    iii) None of these.
6) In electronic (digital) communication, the RZ format has meant that:
    i) The pulse occupies exactly half the bit period.
    ii) The pulse occupies exactly full the bit period.
    iii) The pulse occupies less than 10% the bit period.
7) In optical communication, the RZ format has meant that:
    i) The pulse occupies a substantial fraction (say, 30%) of the bit interval.
    ii) The pulse occupies exactly half of the bit interval.
    iii) The pulse occupies exactly full the bit period.
8) In dispersion-managed (DM) solitons, the RZ systems:
    i) The pulse occupies only a small fraction of the bit interval.
    ii) The pulse occupies a large fraction of the bit interval.
    iii) The pulse occupies exactly full the bit period.
9) The major advantage of the NRZ format over the other formats is:
    i) That the signal occupies a much smaller bandwidth, about half that of the RZ format.
    ii) That the signal occupies a higher bandwidth, about half that of the RZ format.
    iii) None of these.

10) The problem with the NRZ format is that long strings of 1s or 0s will result in a total absence of any transitions:
    i) Making it difficult for the receiver to acquire the bit clock.
    ii) Making it slow for the receiver to acquire the bit clock.
    iii) None of these.
11) RZ format requires a higher peak transmit power in order to:
    i) Maintain the same energy per bit.
    ii) Maintain low energy per bit.
    iii) Maintain high energy per bit.
12) It is important for an OOK modulation scheme to achieve DC balance because this:
    i) Makes it easier to set the decision threshold at the receiver.
    ii) Makes it important to set the decision threshold at the receiver.
    iii) None of these.
13) To ensure sufficient transitions in the signal and to provide DC balance should use:
    i) Line coding.
    ii) Scrambling.
    iii) None of these.
14) One form of a binary block line code encodes a block of k data bits into:
    i) n > k bits that are then modulated and sent over the fiber.
    ii) Group all bits in random, then modulated and sent over the fiber.
    iii) Both can happen.
15) At the transmitter, a scrambler takes the incoming bits and:
    i) Does an EXOR operation with another carefully chosen sequence of bits.
    ii) Does an complicated operation with another carefully chosen sequence of bits.
    iii) None of these.
16) In practice, the NRZ format is used in most high-speed communication systems:
    i) Ranging from speeds of 155 Mb/s to 10 Gb/s.
    ii) Ranging from speeds of 10 Gb/s and above.
    iii) Ranging from speeds up to 155 Mb/s.

17) The use of RZ pulses to:
    i) Minimizes the effects of chromatic dispersion.
    ii) Absorb the effects of chromatic dispersion.
    iii) Delete the effects of chromatic dispersion.
18) The optical signal emitted by a laser operating in the 1310 or 1550 nm wavelength band has:
    i) a center frequency around 10^{14} Hz and called the optical carrier.
    ii) a center frequency around 10^{08} Hz and called the optical carrier.
    iii) a center frequency around 10^{10} Hz and called the optical carrier.
19) The microwave carrier is called the subcarrier, with the optical carrier being considered the main carrier. This form of modulation is called:
    i) Subcarrier modulation.
    ii) Microwave modulation.
    iii) Laser modulation.
20) The main motivation for using subcarrier modulation is:
    i) To multiplex multiple data streams onto a single optical signal.
    ii) To multiplex each single data onto a single optical signal.
    iii) None of these.

21) Subcarrier modulation can be done by combining multiple microwave carriers:
    i) At different frequencies and modulating the optical transmitter with the combined signal.
    ii) At the same frequencies and modulating the optical transmitter with the combined signal.
    iii) None of these.
22) At the receiver, the signal is detected like any other signal, and the rest of the processing, to separate the subcarriers and extract the data from each subcarrier, is done electronically. This form of multiplexing is called:
    i) Subcarrier multiplexing (SCM).
    ii) Optical modulation.
    iii) Digital modulation.
23) SCM is used to combine:
    i) A control data stream along with the actual data stream.
    ii) A stream correction data along with the actual data stream.
    iii) None of these.

Part -2 Draw these diagrams:

1) On-off keying modulation of binary digital data.
2) The subcarriers modulation module for an optical system.
3) Spectrum of a baseband signal compared with the spectra of double sideband (DSB) and single sideband (SSB) modulated signals.
4) Block diagram showing the various functions involved in a receiver.