## Unit-3

#### Lecture -7

LASER Working, Threshold Condition, Reliability

### How a Laser Works





#### **Optical output vs. drive current of a laser**



Laser diode drive current

### Laser threshold depends on Temperature



## Modulation of Optical Sources

- Optical sources can be modulated either directly or externally.
- Direct modulation is done by modulating the driving current according to the message signal (digital or analog)
- In external modulation, the laser emits continuous wave (CW) light and the modulation is done in the fiber

# Why Modulation

- A communication link is established by transmission of information reliably
- Optical modulation is embedding the information on the optical carrier for this purpose
- The information can be <u>digital</u> (1,0) or <u>analog</u> (a continuous waveform)
- The <u>bit error rate</u> (BER) is the performance measure in digital systems
- The <u>signal to noise ratio</u> (SNR) is the performance measure in analog systems

#### Important parameters used to characterize and compare different modulators

- Modulation efficiency: Defined differently depending on if we modulate intensity, phase or frequency. For intensity it is defined as (Imax – Imin)/Imax.
- Modulation depth: For intensity modulation it is defined in decibel by 10 log (Imax/Imin).
- Modulation bandwidth: Defined as the high frequency at which the efficiency has fallen by 3dB.
- Power consumption: Simply the power consumption per unit bandwidth needed for (intensity) modulation.