Unit-5

### Lecture -6

WDM, OTDR

# What is DWDM?

- Definition
  - Dense wavelength division multiplexing (DWDM) is a fiber-optic transmission technique that employs light wavelengths to transmit data parallel-by-bit or serial-by-character



### How does DWDM fair better?

- No O-E-O required
- Protocol & Bit Rate independence
- Increased overall capacity at much lower cost
  - Current fiber plant investment can be optimized by a factor of at least 32
- Transparency
  - Physical layer architecture → supports both TDM and data formats such as ATM, Gigabit Ethernet, etc.
- Scalability
  - Utilize abundance of dark fibers in metropolitan areas and enterprise networks

### **Capacity Expansion**



# **Basic Components & Operation**

#### • Transmitting Side

- Lasers with precise stable wavelengths
- Optical Multiplexers
- On the Link
  - Optical fiber
  - Optical amplifiers
- Receiving Side
  - Photo detectors
  - Optical Demultiplexers
- Optical add/drop multiplexers



## **Optical Amplifier**



- Eliminates O-E-O conversions
- More effective than electronic repeaters
- Isolator prevents reflection
- Light at 980nm or 1480nm is injected via the pump laser
- Gains ~ 30dB; Output Power ~ 17dB

## Drawbacks

- Dispersion
  - Chromatic dispersion
  - Polarization mode dispersion
- Attenuation
  - Intrinsic: Scattering, Absorption, etc.
  - Extrinsic: Manufacturing Stress, Environment, etc.
- Four wave mixing
  - Non-linear nature of refractive index of optical fiber
  - Limits channel capacity of the DWDM System

# **Ongoing Developments**

- Nortel Networks
  - Metro DWDM
  - OPTera Long Haul 5000 Optical Line System
- Cisco Systems
  - ONS 15200 Metro DWDM Solution
- Lucent Technologies
  - LambdaXtreme Transport
  - WaveStar OLS 1.6T
- Agility Communications & UC Santa Barbara
  - Tunable Lasers used for multiple wavelengths

## Conclusion

- Robust and simple design
- Works entirely in the Optical domain
- Multiplies the capacity of the network many fold
- Cheap Components
- Handles the present BW demand cost effectively
- Maximum utilization of untapped resources
- Best suited for long-haul networks