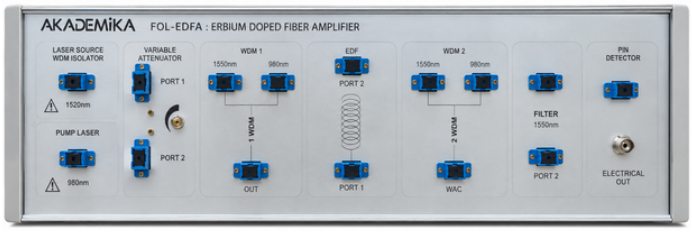
FOL-EDFA

Erbium-Doped Fiber Amplifier Module

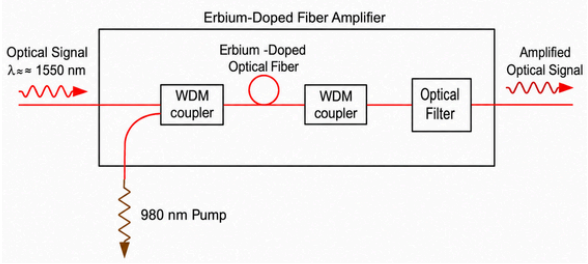


FEATURES

- EDFA System enables student to experimentally investigate the principles and characteristics of EDFA in C Band (1530nm ~ 1565nm)
- Demonstrates amplification of 1550 nm wavelength along with the detection and measurement of amplified signal.
- Investigation and Analysis of Small and Large Signal Gain
- Facility to implement Forward and Backward Pumping and Study Gain Characteristics

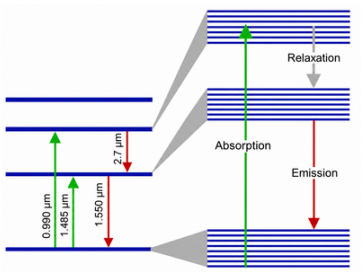
EDFA Block Diagram

- 1550nm signal and 980nm pumped inside EDF
- 2:1 WDM system is used to combine pump and optical signal (1550nm)



- The Erbium atoms absorb 980nm pump signal and jump to higher energy state
- 1550nm strikes excited Er+3 ions and initiate Stimulated Emission
- 1550nm amplified by stimulated emission

Amplification Principle



- Figure above describe the energy level diagram for Er+3 ion
- 1480 nm pump excites Er+3 to quasi metastable stage
- Coincidently, emits wavelengths in the range 1525-1565nm range while returning back to ground state from quasi-metastable stage
- This amplifies the signal by stimulated emission.

SPECIFICATIONS

LASERS @1550nm

- 1.25 Gbps Laser Diode Module at wavelength of 1550nm
- In built Isolator
- Channel Spacing : 20 nm
- Threshold Current Ith : 10 mA Typical
- Output Power : @ Ith + 30 mA - > 0.7 mW
  @ ~ 58 mA-> 1.4 mW
- Operating Voltage : 1.1V Typical

PUMP LASER@974nm

- Up to 100 / 150mW TEC Control 980nm Pump Module
- Maximum Operating Power : 100 mW
- Maximum Operating Current : 340mA
- Center Wavelength : 974nm +-2
- Optical Connector : SC/APC

Optical Detector

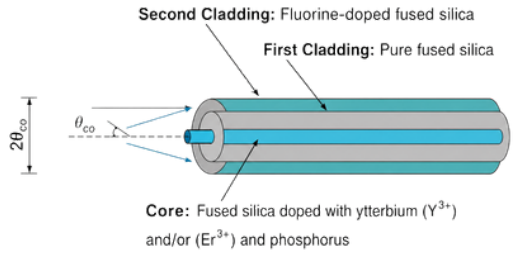
- 1.5 GHz InGaAs PIN Photodiode Module.
- Responsivity : Typical 0.9 A/W in 9/125 µmfiber
- Spectral Range : 1250nm to 1600nm
- Reverse Voltage : 30 V max.
- Optical Connector : SC/APC

Wavelength Division Multiplexer

- Operating Wavelength(nm) : 974/1550
- Max. Insertion Loss (dB) : 0.20
- Isolation (dB) : >20
- Polarization Sensitivity(dB) : <0.05

Erbium Doped Fiber

- The core of the fiber is doped with Erbium.
- In EDF fiber core acts as gain medium or Host



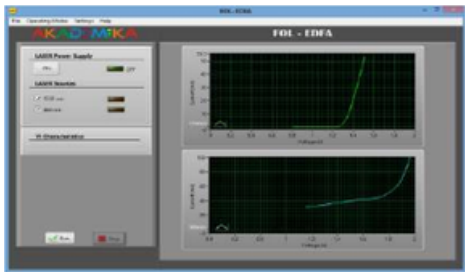
- MFD (Nominal) : 5.5 - 6.3um@1550nm
- Core NA : 0.21 - 0.24
- Cut - off Wavelength : 900 - 940nm
- C-Band Single Mode Fiber : (1530 - 1565nm)
- Peak Absorption : 4.5-5.5 dB/m@980nm 5.4-7.1 dB/m@1531nm

Software

- User friendly GUI for monitoring, controlling of EDFA system
- Operating modes like CW mode, VI characteristics mode, Internal & External Modulation
- LASER control like Supply ON/OFF, wavelength selection and driving current selection.
- Real time signal level monitoring of Photo-detector.
- Graphical representation : XY plot of VI characteristics and Internal Modulation
- COM Settings : USB 2.0

Software Interface

1. VI Characterisation of Pump and Laser Source

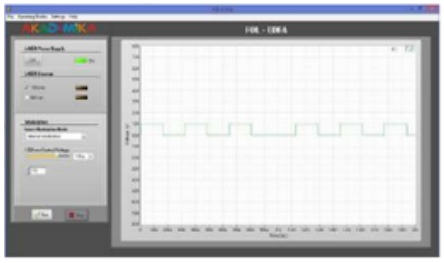


- Above picture shows the VI characteristics of pump and source LASER.
- VI characteristics of both LASERs could be observed in the software by selecting VI characteristics in the Operating Mode option.

2. LASER CONTROLS

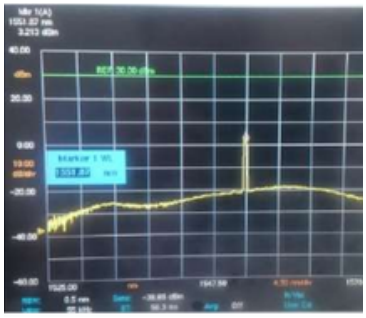
- Individual LASER voltage can be controlled using slider provided in software
- LASER voltage and corresponding LASER current is displayed on the screen

3. MODULATION MODE



- LASER voltage controls provided
- Select LASER on Left column
- Internal and External modulation options available
- 4 Modulation frequencies (100Hz, 200Hz, 500Hz, 1KHz) can be used
- Modulated signals displayed on graph in right column

4. OPTICAL SPECTRUM ANALYZER DISPLAY



Output Spectrum of EDF with Signal Source (1550nm)

ACCESSORIES

- Shielded USB A-A cable : 01No
- Power Cable : 01No
- SC-SC Single Mode Fiber Optic Patch Chords : 06No
- BNC to BNC coaxial cable : 01No
- Software on CD : 01No
- FTDI Drivers
- Experimental Manual : 01No

EXPERIMENTS

- Measuring Small-Signal Gain
- Measuring Gain Saturation
- Measuring Saturation Output Power
- Measuring Pump Saturation
- Measurements under Modulation
- Implementation of Forward Pumping and Backward Pumping