

**COMPREHENSIVE LABORATORY BASED EDUCATIONAL PACKAGE IN ERBIUM DOPED FIBRE AMPLIFIERS (EDFAs)**



**MAIN FEATURES AND BENEFITS:**

- All fibre optic and optoelectronic hardware required to perform the experimental investigation
- Extensive literature support including: student and instructor's manuals with exercises, solutions & sample results
- Detailed lecture notes, tutorial examples and solutions to assist with the development of courses
- Saves 2-3 years of course, literature and hardware development effort

**THE EXPERIMENTAL INVESTIGATION\* ADDRESSES:**

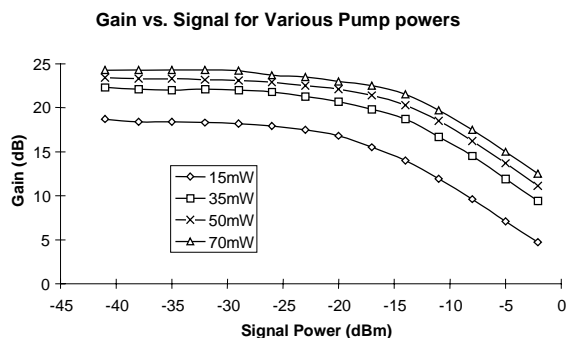
- Full gain characteristics: small and large signal gain
- Signal / gain saturation
- Pump saturation
- Transparency point, gain gradient and gain efficiency
- Saturated output power
- Amplified spontaneous emission (ASE) levels
- ASE-ASE & Signal-ASE beat noise
- Noise figure

\* Full details of the experiments and equipment specifications are provided overleaf

## Laboratory Exercises

The EDFA educator kit enables students to investigate the basic principles of optical amplification, to characterise the key technical performance parameters of EDFAs, and to develop an appreciation of the engineering applications of optical amplifiers and their limitations within these applications. The experiments include:

- Measurement of output power and gain over a large range of input signal levels for several fixed pump levels. This enables investigation of small signal gain, large signal gain and gain saturation.
- Determination of the saturated output power as a function of pump power.



- Measurement of output power and gain as a function of pump power at various levels of signal power.
- Determination of point of transparency, gain gradient and gain efficiency.
- Measurement of amplified spontaneous emission (ASE) as a function of pump power for no signal and various input signal levels spanning the range of small signal to signal saturation.
- Measurement of optical noise (ASE–ASE beat noise and Signal–ASE beat noise) as a function of input signal strength for various pump powers.

## Product Description

The OPTOSCI EDFA laboratory educator kit consists of the following hardware elements:

- A connectorised erbium doped fibre amplifier pumped by a 980nm laser diode to provide small signal gains in excess of 25dB. The amplifier contains two optical isolators and has angle polished connectors to limit positive feedback and completely suppress oscillation (i.e. laser action).
- A 1550nm DFB laser source to provide the input signals. The source has been specially designed to provide signal levels in a range from approximately -40dBm up to 0dBm (1mW) without degradation of its coherence properties (i.e. its linewidth). This is required to enable the investigation of small and large signal gain with gain saturation.

- A custom designed photodiode detection system for measuring the input signal levels over a large (50dB) dynamic range. The unit also allows the measurement of the amplified AC signal power super imposed on a high quasi DC level of ASE.
- Fixed 15dB In-line optical attenuator
- All of the necessary fibre cable patchcords to enable connection between the various units of the system.

In addition, a comprehensive literature package accompanies each kit:

- A set of student laboratory manuals describing the background theory and experimental procedure, with associated exercises to encourage the student to discuss the implications of their results.
- A complete instructor's manual dealing with all aspects of using the equipment and providing sample results for the experiments and exercises.
- Extensive lecture notes on EDFAs and their applications.
- A comprehensive set of tutorial examples and their solutions.

## Accessories / Extension Modules

- SPECS: Laser safety spectacles with OD3+ at 1550nm are available directly from OPTOSCI.
- FILTER: An optical filter module enables investigation of the impact of optical filtering on the ASE & noise levels of the amplifier.
- A LASE add-on module to ED-AMP is available to extend this system to investigate the principles and characteristics of lasers (see LASE module datasheet for full details).
- A fully independent ED-LASE Principles of Lasers educator kit is also available (see ED-LASE datasheet for full details)

*Additional required equipment:-*

- A two channel laboratory oscilloscope with a minimum bandwidth of 20MHz.

## Ordering Information

**ED-AMP** Erbium Doped Fibre Amplifiers

**SPECS** Laser Safety Specs. OD3+ 1550nm

**FILTER** Optical Filter Module

**LASE** Lasers Module

Since OPTOSCI are committed to continuously improving the design and performance characteristics of our products, these specifications are subject to change without notice.

Date: February 2006