OPTOSCI
...OPTOELECTRONIC SYSTEMS, COMPONENTS, INSTRUMENTATION...

Short Form Catalogue

Photonics Educator Kits

THE IMMEDIATE SOLUTION TO UNIVERSITY & COLLEGE PHOTONICS TEACHING LABORATORIES

PHYSICAL OPTICS ***OPTICAL COMMUNICATIONS & BER***

OPTICAL WAVEGUIDES & FIBRES ***OPTICAL NETWORKS & OTDR***

EDF AMPLIFIERS & LASERS ***WDM SYSTEMS & BRAGG GRATINGS***

FULLY INTEGRATED PHOTONICS TEACHING LABS

EACH PACKAGE SAVES SIGNIFICANT COURSE, LITERATURE AND HARDWARE DEVELOPMENT EFFORT AND INCLUDES:

- All required optoelectronic hardware
- Detailed Student & Instructor manuals (latter with full sample results)

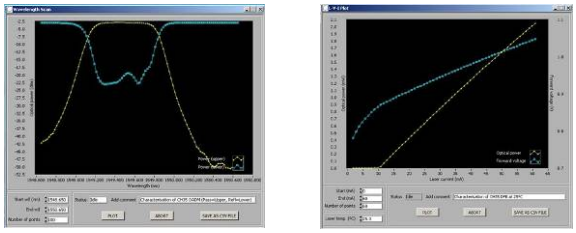
ED-WAVE: Principles of Optical Waveguiding

- Comprehensive notes for use in lecture courses
- Extensive tutorial examples, design exercises and case studies (with solutions for the instructor)

ED-COM with BER(COM): Fibre Optic Communications & Bit Error Rates

INNOVATIVE DESIGN PHILOSOPHY ENSURES:

- All desired educational objectives are met
- Students are able to investigate all essential physical principles and technical issues
- Each kit is offered at a price which is realistic within academic budgets



ED-WDM Series: WDM Components, WDM Systems & Bragg Gratings

- All experiments may be reconfigured as open-ended projects for problem based learning type labs
- Fundamental principles, enabling technologies and applications are covered
- Design & educational input from senior academics in world renowned Photonics groups at Strathclyde & Heriot-Watt Universities

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Photonics Educator Kits

OptoSci's unique range of photonics laboratory teaching packages offer an immediate solution to the provision of comprehensive and stimulating experimental courses in key areas of optics, optoelectronics, and optical communications. The kits are suitable for university & college courses and each fully self-contained package saves the tutor significant course, literature, and hardware development effort. The kits include:

- All of the optical components and optoelectronic instruments required to perform the experiments
- Clearly documented instructor's manual with full experimental results and exercise solutions.
- Set of student laboratory manuals describing the background theory and experimental procedure
- Lecture or background notes detailing the underlying principles behind the laboratory experiments
- Series of tutorial questions, design exercises and case studies (all with solutions).

Principles of Optical Waveguiding — ED-WAVE

- Reflection and refraction characteristics at an internal & external optical interface for both vertical and horizontal polarisation states
- Confirmation of Snell's Law and the Fresnel Equations
- Identification of features such as Brewster's Angle and the critical angle for total internal reflection
- Determination of the refractive index of an optical element
- Investigation of step index and graded index waveguides using prism coupling techniques and m-line investigations
- Identification of substrate modes, coupling to waveguide modes, observation of mode lines
- Measurement of TE & TM mode spectrum, modal effective indices and polarisation dependence of modes
- Determination of the refractive index profile and depth of the waveguides under study
- Design of single mode step and graded index waveguides with experimental confirmation of single mode operation.

Also available: ***SWAN(MIC)*** *Optical waveguide analysis software for use with ED-WAVE allowing the user to study planar optical waveguides experimentally and theoretically (full datasheet available at www.optosci.com).*

Extension module for ED-WAVE: ***Fibre Optics (FIB)*** *allows students to investigate free space coupling of light into optical fibres, examine output mode patterns, determine NA of various fibres, and go on to explore axial misalignment, connector loss, bend loss and attenuation in optical fibres. The FIB module provides an ideal link between the ED-WAVE and ED-COM educator kits.*

Fibre Optic Communications — ED-COM

- Experimental characterisation of all the major components of a fibre optic communications link (i.e. the transmitter, the optical fibre and the receiver) and investigation of the overall system performance of a 1, 2 & 3km link using a laser diode and LED transmitter
- Measurement of the P-I characteristics of the laser diode and LED transmitters and the transmitter launched powers
- Determination of the receiver noise and sensitivity
- Measurement of connector loss, attenuation along optical fibre links, and determination of the fibre attenuation coefficient
- Measurement of the step, frequency and impulse response of the transmitter / receiver units, the system, and the fibre
- Results analysis to determine the material and intermodal dispersion coefficients, the bit rate / bandwidth.distance products and the upper limits on the link length, bandwidth and bit rate as determined by attenuation and dispersion in the fibre.

Extension module for ED-COM: ***BER(COM)*** *generation and evaluation of eye diagrams and investigation of the effects of noise, attenuation and dispersion on eye diagrams and BER in optical communication systems (full datasheet available at www.optosci.com).*

Optical Network Analysis — ED-NET

- Experimental investigation of the fundamental properties of Optical Time Domain Reflectometry (dead zone, distance and spatial resolution, dynamic range, etc.), with identification of events and their location along a fibre link.
- Various loss mechanisms along the link are examined and measured at both 1300nm and 1550nm (i.e. Rayleigh scattering, Fresnel reflection, losses from connectors, fibre bends, standard splices and splices between standard & dispersion shifted fibre).
- Measurement of the response of optical fibre components (fibre coupler and wavelength division multiplexer).
- Characterisation of multi-branched optical networks with bi-directional examination of certain fibre networks
- Fault location, identification and analysis on a series of networks with deliberately introduced faults.

WDM Components, WDM Systems & Bragg Gratings — ED-WDM Series

ED-WDM Series is a modular series of kits that can be expanded to allow investigation of Wavelength Division Multiplexed (WDM) Components, 1310/1550nm WDM, Dense WDM & Bragg Gratings.

- Measurement of insertion losses and backreflection / return loss for appropriate output ports and determination of isolation/extinction ratios of a series of optical components at 1550nm & 1310nm.
- Examination of the narrowband wavelength response and characterisation of Bragg grating and DWDM modules
- Investigation of temperature tuning of a Bragg grating and its role as a temperature sensor
- Measurement and plotting of light, voltage, current (LVI) characteristics of lasers with operating temperature
- Assembly and characterisation of a two channel 1310nm & 1550nm WDM system
- Optical fibre length measurement and attenuation at 1310nm & 1550nm
- Estimation of chromatic dispersion using 1310nm & 1550nm sources
- Examination of a two channel DWDM system, channel add/drop, and measurement of system crosstalk / channel isolation
- Effect of wavelength drift on DWDM system crosstalk / channel isolation
- Investigation of crosstalk effects on the eye diagram / BER in DWDM systems

Add-on to DWDM: ***4-Ch.DWDM Ext*** *extends the DWDM module to allow assembly & investigation of a 4-Channel DWDM system*

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Erbium Doped Fibre Amplifiers — ED-AMP

- Measurement of the gain characteristics of the amplifier as a function of input signal power for various pump powers.
- Investigation of small and large signal gain, gain saturation, point of transparency, gain gradient and gain efficiency.
- Measurement of pump saturation and saturated output power
- Measurement of the amplified spontaneous emission (ASE) levels as a function of input signal level over a range of pump powers.
- Investigation of ASE-ASE beat noise, Signal-ASE beat noise and noise figure under various pump and signal conditions.
- An optical filter module (available separately) enables investigation of the filter's impact on the ASE and noise levels of the amplifier.

Extension module for ED-AMP: ***LASE*** *fibre laser add on module allowing experimental investigation of the characteristics of a series of fibre ring lasers using ED-AMP's EDFA as the laser gain medium (see ED-LASE section for experimental description).*

Principles of Lasers — ED-LASE

Independent and self-contained educator kit allowing construction of a series of fibre ring lasers using an EDFA as the laser gain medium with feedback provided by various fused fibre couplers.

- Measurement of power / pump characteristic of the laser for several output coupling ratios and various levels of intra-cavity loss.
- Investigation of the variation of threshold and slope efficiency with output coupling ratio and intra-cavity loss.
- Measurement of relaxation oscillations for different pump powers, levels of intra-cavity loss and coupling ratios
- Investigation of the square of the relaxation oscillation frequency versus pump power in order to derive the excitation lifetime.
- Examination of laser onset time delay as a function of different pump powers, levels of intra cavity loss and output coupling ratios.

Principles of Physical Optics — ED-OPTICS

The Principles of Physical Optics educator kit addresses the fundamental properties of light and the principles of physical optics.

- ED-OPTICS consists of four individual modules covering detailed experiments in polarisation, reflection and refraction, diffraction, interference and coherence (further details of the experiments are included in the module descriptions below).
- ED-OPTICS (Complete) contains all the equipment required to perform the experiments in the four modules simultaneously.
- ED-OPTICS (Modular) contains all the equipment required to perform the experiments in the four modules sequentially.
- Individual modules can also be purchased separately (e.g. POL, R&R, DIFF, I&C),
- An add-on module enabling the investigation of optical waveguiding (WAVE) is also available (see ED-WAVE section for experimental description).

Polarisation — POL

- Alignment of a polariser / analyser combination and confirmation of Malus' law.
- Investigation of the properties of a half wave plate (alignment, axes identification, polarisation characteristics) and quarter wave plates (alignment, axes identification, polarisation characteristics, individually and two QWP in combination).
- Investigation of the state of polarisation of a light wave, Stokes parameters and the polarisation ellipse with linear polarisation, elliptical polarisation, arbitrary wave plate
- Examination of strain induced birefringence and its application to strain sensing.

Reflection and Refraction — R&R

- Reflection and refraction characteristics at an internal & external optical interface for both vertical & horizontal polarisation states.
- Confirmation of Snell's Law at low to high index and high to low index optical interfaces.
- Confirmation of the Fresnel Equations at different optical interfaces and under different polarisation states
- Identification of features such as Brewster's Angle and the critical angle for total internal reflection.
- Determination of the refractive index of an optical element.

Diffraction — DIFF

- Investigation of near and far field diffraction patterns for apertures & slits of various dimensions (Fraunhofer & Fresnel diffraction).
- Confirmation of the width of various known slits and apertures; determination of the width of unknown slits and apertures.
- Experimental investigation of diffraction at a reflective grating, including the basic grating equation (confirmation of grating line density).
- Multiple order diffraction, the Littrow configuration, grating resolution, dispersion and resolving power as a function of incidence angle and diffraction order using two laser wavelengths.
- Determination of the wavelength of a second laser and diffraction through a transmission grating and measurement of line spacing.

Interference and Coherence — I&C

- Construction and alignment of a Michelson interferometer & investigation of its multiple and single fringe alignment configurations.
- Assessment of the surface quality of three different optical elements inserted into one arm of the interferometer.
- Calculation of the wedge angle for one of the elements.
- Investigation of the coherence functions of a Helium-Neon and a Fabry-Perot cavity laser.
- Examination of how the Fabry-Perot cavity laser's coherence length changes as the laser's drive current is varied.
- Determination of the coherence length of the laser diode above & below threshold current and measurement of its cavity length.

Integrated Photonics Teaching Labs

Combining OptoSci's extensive range of educator kits with third party instrumentation we can also design and supply fully integrated teaching and training labs covering areas from basic optics, fibre optics and optical communications, through to advanced optical communications applications, instruments and technology. Please contact OptoSci to discuss your requirements further.

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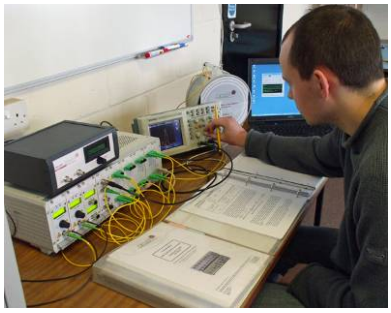
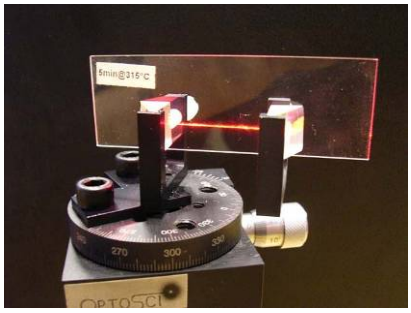
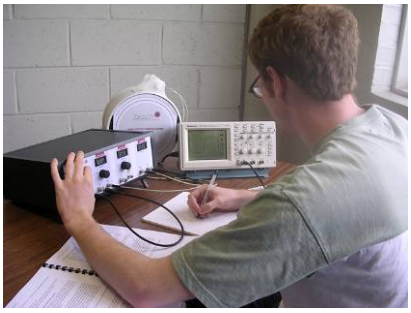

OptoSci's Photonics Educator Kits are comprehensive laboratory based educational kits suitable for universities, colleges, education & training centres teaching: optics, optoelectronics, fibre optics and optical fibre communications related courses.

Features	Benefits
Fully self contained package	⇨ Saves significant course, literature and hardware development time
Competitively priced	⇨ Available for a price which is realistic within academic budgets
Innovative system design with all specialised experimental hardware supplied	⇨ Allows immediate installation in the laboratory and compatible with standard laboratory test instrumentation
Comprehensive laboratory literature support	⇨ Full background and experimental support for tutor and student
Detailed lecture / background notes and tutorials provided	⇨ Provides extensive support material for lecture course
Designed in conjunction with leading academics from Strathclyde & Heriot-Watt Universities	⇨ Totally relevant to photonics courses in academia
Easily tailor experimental programme for different student levels	⇨ Suitable for all university undergraduate and masters level photonics courses in Physics and Electronic Engineering
Kits examine fundamental principles, key technical issues & applications of the technology	⇨ Straightforward to reconfigure for open ended projects and problem based learning labs
Innovative design philosophy	⇨ Ensures that all desired educational objectives are realised and that students investigate all major technical issues
Over a thousand kits are currently used in leading academic institutions world-wide and we experience continued repeat business	⇨ Positive endorsement of the educational value of the products by both tutors and students
Full product support is available	⇨ Just contact us by e-mail or phone

Visit the Product Support section of our website (www.optosci.com) to access extensive additional information on OPTOSCI's range of photonics educator kits, such as: full data sheets, a sample student manual, detailed educator kit specifications, and journal publications on the kits.

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

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