OPTICAL DESIGN & TESTING SHORT COURSE PROGRAM

OFFERED BY

College of Optical Sciences
THE UNIVERSITY OF ARIZONA®

November 15 – 16, 2007

New Miyako Hotel

Kyoto, Japan

SHORT COURSE FORMAT & DESCRIPTION

Courses will be taught by professors from the University of Arizona, College of Optical Sciences in the United States of America. Three one-day short courses will be presented live. In addition, two half-day courses will be taught from DVD with a live question and answer section by phone/video link to the USA.

Courses are taught in English.

Course titles:

- Introduction to Optical Polarization
- Polarization in Optical Design
- Geometrical Optics
- Optical Design with Mirrors
- Introduction to Interferometric Optical Testing

Administrative support is provided by NALUX Co., Ltd. a leading supplier of aspheric lenses and optical assemblies. (http://www.nalux.co.jp)

Additional information is placed on the College of Optical Sciences web site:
www.optics.arizona.edu.

Please direct questions or comments to:

Russell A. Chipman
Professor, College of Optical Sciences, University of Arizona
russell.chipman@optics.arizona.edu
Tel: 520-626-9435

College of Optical Sciences
THE UNIVERSITY OF ARIZONA

The College of Optical Sciences at the University of Arizona in Tucson Arizona is the world's premier optics research institute. Optical Sciences has 55 faculty members performing research in all areas of optical engineering and optical physics who are recognized worldwide for their strong leadership abilities and outstanding research records. The international student body includes 440 undergraduate and graduate students. Optical Sciences maintains close relationships with the optics industry including special ties with many Japanese companies. The College of Optical Sciences was founded in 1964. Graduate coursework in optics taught on-campus in Arizona and is also available through our distance learning program, http://www.optics.arizona.edu/academics/videoclasses.htm.

Meeting Location

New Miyako Hotel

17, Nishikujo-Inmachi,Minami-ku, Kyoto 601-8412, Japan
phone.075-661-7111fax.075-661-7135
http://www.miyakohotels.ne.jp/newmiyako/english/index.html
Directly across the street from Kyoto Train Station to the south.

The short courses are offered in the ultra-modern New Miyako Hotel, conference rooms “Katsura” , “Yasaka” and “Fukakusa”.

On site parking: 93 lots ￥250/30miniutes, ￥3500 max /day

Lodging Information

New Miyako Hotel is located at

17, Nishikujo-Inmachi,Minami-ku, Kyoto 601-8412, Japan
phone.075-661-7111fax.075-661-7135

Website: http://www.miyakohotels.ne.jp/newmiyako/english/index.html

Individuals are responsible for making their own hotel reservation.

Course Fee

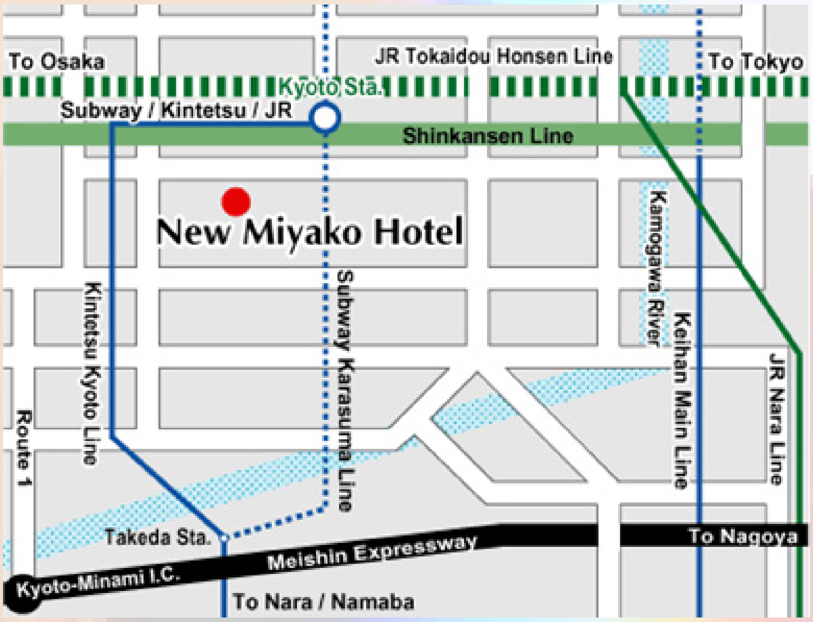
Tuition 98,000¥ (Live Courses – per Full Day)

Tuition 48,000¥ (DVD Courses – per Half Day)

This fee includes lectures, course notes, morning and/or afternoon breaks.

A certificate of completion will be issued at the end of each course.

Train Access



Easy Access

Osaka	about 30 minutes by shin-Kaisoku from JR Osaka Station
Kobe (Sannomiya)	about 55 minutes by Shin-Kaisoku from JR Sannomiya Station
Kansai International Airport	about 75 minutes by JR Kanku Express "Haruka" from KIA Station
Osaka Airport	about 50 minutes by airport shuttle bus
Meishin Expressway	Kyoto-Minami (South) Interchange - about a 15-minute drive

Course Faculty

Russell A. Chipman

rchipman@optics.arizona.edu

Professor, Optical Sciences
University of Arizona
Course Director

Professor Chipman runs the Polarization Laboratory at the College of Optical Sciences which performs research into polarization elements, liquid crystals, and polarization aberrations. He managed optics departments at JDS Uniphase and Johnson and Johnson and was also a Physics professor at the University of Alabama in Huntsville. He has developed many unique spectropolarimeters and imaging polarimeters and conducted studies into polarization in fiber components, waveguides, liquid crystals, polarization elements, and natural polarization signatures. He holds twelve patents in optics. He received his BS from MIT and his M. S and Ph. D. in Optical Science from the University of Arizona. Prof. Chipman is a Fellow of OSA and SPIE, a Topical Editor for Applied Optics, and is the 2007 recipient of SPIE's G. G. Stokes Award for research into polarization. He chairs the Polarization Engineering group within the Optical Society of America.

John E. Greivenkamp

greiven@arizona.edu

Professor, Optical Sciences & Ophthalmology
University of Arizona

Professor Greivenkamp has taught courses in optical engineering since 1991. After receiving a Ph.D. from the Optical Sciences Center in 1980, he was employed by Eastman Kodak. He is a fellow of SPIE-the International Society for Optical Engineering and of the Optical Society of America. His research interests include interferometry and optical testing, optical fabrication, ophthalmic optics, optical measurement systems, optical systems design, and the optics of electronic imaging systems.

José M. Sasián

jose.sasian@optics.arizona.edu

Professor, Optical Sciences & Astronomy
University of Arizona

Professor Sasian's professional interests are in optical design, teaching optical sciences, optical fabrication, alignment and testing, telescope technology, opto-mechanics, lens design, lithography, illumination optics, and light propagation.

James C. Wyant

jcwyant@optics.arizona.edu

Professor and Dean
Optical Sciences
University of Arizona

Professor Wyant received his B.S. in physics in 1965 from Case Western Reserve University and M.S. and Ph.D. in optics from the University of Rochester in 1967 and 1968. He was an optical engineer with Itek Corporation from 1968 to 1974, when he joined the faculty of the Optical Sciences Center at the University of Arizona, where he now is a Professor of Optical Sciences and Dean of the College of Optical Sciences. He was a co-founder of the WYKO Corporation and the president from 1984 to 1997. He was also a co-founder of 4D Technology and currently serves as its Board Chairman. Wyant has published more than more than 300 written publications and invited talks on interferometry, holography, and optical testing, and he was the co-editor of the book series, *Applied Optics and Optical Engineering*, co-author of the *Field Guide to Interferometric Optical Testing* and he is the current editor-in-chief of Applied Optics.

Course Program & Schedule

LIVE PRESENTATIONS

9:00 - 10:30 am	Lecture
10:30 - 10:45	Break
10:45 - 12:30 pm	Lecture continues
12:30 - 2:00 pm	Lunch *(On your own)*
2:00 - 3:45	Lecture continues
3:45 - 4:00	Break
4:00 - 5:30 pm	Lecture - wrap-up

DVD PRESENTATIONS

9:00 - 10:30 am	"Optical Design with Mirrors"
10:30 - 10:45	Break
10:45 - 12:30 pm	Lecture - wrap up
12:30 - 2:00 pm	Lunch *(On your own)*
2:00 - 3:45	"Interferometric Optical Testing"
3:45 - 4:00	Break
4:00 - 5:30 pm	Lecture - wrap-up

Thursday, November 15, 2007

Russell A. Chipman

Room Name (Yasaka)

9:00 – 5:30 p.m.

"Introduction to Optical Polarization" *– Live Course*

The basics of polarized light, polarization elements, and polarization measurements are presented in this introductory course.

The emphasis is on the practical aspects of polarization elements and polarization measurements. The basic mathematics of the Poincare sphere, Stokes vectors, and Mueller matrices are presented and applied to describe polarized light and polarization elements. Polarizers and retarders are introduced and their principal uses explained. The non ideal characteristics of polarization elements, liquid crystals, and birefringent films are discussed with examples.

Learning Outcomes:

This course will prepare you to:

- Understand the function of the basic polarization elements: polarizers, quarter wave and half wave retarders, circular retarders, and depolarizers.
- Use Jones vectors and Stokes vectors to describe linear, circular, and elliptically polarized light in optical instruments and the natural environment
- Understand the interference of polarized light in interferometers
- Simulate sequences of polarization elements with the Mueller matrices
- Understand the common defects of polarization elements and how to measure and characterize these defects

Intended Audience:

This class is intended for engineers, scientists, and managers who need an introduction to polarization concepts.

Course Level: Introductory

Thursday, November 15, 2007

John E. Greivenkamp

Room Name (Katsura)
9:00 – 5:30 p.m.

"Geometrical Optics" *– Live Course, Notes provided in Japanese and English*

This course will provide the attendee with a fundamental understanding of optical system design and instrumentation. The course material is organized around the first-order design, layout and specification of optical systems. The course includes topics such as imaging with thin lenses and systems of thin lenses, Gaussian and paraxial optics, stops and pupils, radiative transfer, and illumination. Numerous examples of optical systems are described. A special emphasis is placed on the practical aspects of the design of optical systems. Participants will receive the course viewgraphs in English and a copy of Japanese language version of the book "The Field Guide to Geometrical Optics" by Prof. Greivenkamp.

Learning Outcomes:

This course will enable you to:

- Specify the requirements of an optical system for your application including magnification, object-to-image distance, and focal length.
- Combine multiple optical elements into a single optical system.
- Specify required element diameters.
- Determine the image plane irradiance or brightness.
- Become familiar with a variety of optical instruments and systems including magnifiers, field and relay lenses, telescopes, microscopes and illumination systems.
- Understand the process of the design and layout of an optical system.

Intended Audience:

This course is intended for anyone who needs to use or design optical systems. No previous knowledge of optics is assumed and only basic mathematics is used (algebra, geometry and trigonometry). By the end of the course, these techniques will allow the design and analysis of relatively sophisticated optical systems.

Course Level: Introductory

Friday, November 16, 2007

Russell A. Chipman
Room Name (Yasaka)
9:00 – 5:30 p.m.

"Polarization in Optical Design" *– Live Course*

This course provides a survey of issues associated with calculating polarization effects in optical systems using optical design programs. Many optical systems are polarization critical and require careful attention to polarization issues. Such systems include liquid crystal projectors, imaging with active laser illumination, very high numerical aperture optical systems in microlithography and data storage, DVD players, imaging into tissue and turbid media, optical coherence tomography, and interferometers.

Polarization effects in optical design are complex: retardance has three degrees of freedom, diattenuation (partial polarization) has three degrees of freedom, and depolarization, the coupling of polarized into partially polarized light, has nine degrees of freedom. Due to this complexity, polarization components and the polarization performance of optical systems are rarely completely specified.

The polarization aberrations introduced by thin films and uniaxial crystals can be readily evaluated in several commercial optical design codes but these routines are complex and most optical engineers are unfamiliar with the capabilities and the forms of output. Polarization ray tracing routines provide better methods to communicate polarization performance and specifications between different groups teamed on complex optical problems. Better means of technical communication speed the development of complex systems.

Learning Outcomes:

This course will prepare you to:

- Understand how to follow the polarization changes along a ray path through a series of lenses, mirrors, polarization elements and anisotropic materials.
- Learn to calculate the Jones matrices for ray paths through sequences of thin film coated optical elements and interpret the polarization aberrations.
- Understand how polarization state dependent point spread functions and modulation transfer functions are calculated.
- Develop appropriate polarization specifications for optical systems

Intended Audience:

This class is intended for optical engineers, scientists, and managers who need to understand and apply polarization concepts to optical systems. Some prior exposure to optical design programs and to linear algebra would be helpful.

Course Level: Intermediate

Friday, November 16, 2007

José M. Sasián
Room Name (Fukakusa)
9:00 – 12:30 a.m.

"Optical Design with Mirrors" *– DVD Course*

This short course provides insight into the optical design of un-obstructed, un-obscured, non-axially symmetric reflective systems. The most conventional optical systems, such as camera lenses and Cassegrain telescopes, have an axis of symmetry and radial symmetry. Now high performance optical systems using tilted and decentered mirrors have proven their capabilities in many applications. We start by discussing the design of axially symmetric systems and reviewing aberration theory. We show how aberration theory can be extended from symmetric to non symmetric systems, and how aberration balancing is used to find different design forms. Three design examples are worked in detail to highlight the different design techniques. This 3 hours short course should greatly expand the insight of those interested in optical design.

Learning Outcomes:

This course will enable you to:

- Review the basics of wave aberration theory
- Appreciate the use of aberration theory
- Apply symmetry concepts in optical systems
- Learn design methods for un-obscured reflective systems
- Follow some concrete design examples

Intended Audience:

This course is intended for those who want to become familiar with design techniques for un-obscured reflective systems and to expand their horizon in optical design. A basic course in lens design (such as the Geometrical Optics short course from Prof. Grievenkamp) is a prerequisite

Course Level: Intermediate

Friday, November 16, 2007

James C. Wyant
Room Name (Kurama)
2:00 – 5:30 p.m.

"Introduction to Interferometric Optical Testing" *– DVD Course*

This short course introduces the field of interferometric optical testing. Topics covered include basic interferometers for optical testing, concepts of phase-shifting interferometry, testing of flats, spheres, windows, prisms, and corner cubes, long wavelength interferometry, the testing of aspheric surfaces, and the measurement of surface microstructure.

Course Outline:

Introductory remarks

Basic interferometers for Optical Testing

- Two beam interference
- Fizeau and Twyman-Green interferometers
- Basic techniques for testing flat and spherical surfaces
- Shearing interferometers
- Typical interferograms

Phase-Shifting Interferometry

- Basic algorithms
- Single shot phase-shifting (Reducing effects of vibration)

Specialized Optical tests

- Testing windows, prisms, and corner cubes
- Testing cylindrical surfaces

Testing of aspherical surfaces

- Description and techniques for testing aspheric surfaces
- Limitations of current aspheric testing techniques

Measurement of Surface Microstructure

- Non-contact optical profilers
- Vertical scanning optical profilers

Concluding Remarks

- Limitations of direct phase measurement interferometers
- Most important to remember
- References

Learning Outcomes:

This course will enable participants to:

- Explain the basic concepts of interferometric optical testing
- Appreciate the power, capabilities, and limitations of phase-shifting interferometry
- Know how to do interferometric optical testing in the presence of vibration and turbulence
- Understand techniques for testing mirrors, lenses, windows, prisms, and corner cubes
- Compare and understand different aspheric testing techniques
- Understand capabilities and techniques for measuring surface microstructure
- Describe the current state-of-the-art of direct phase measurement interferometers

Intended Audience:

Engineers, scientists, and managers who need to understand modern interferometric optical testing techniques and the advantages and disadvantages of the various optical tests.

Registration

For online registration, please contact the College of Optical Sciences web pages. The web page address is as follows;

http://www.optics.arizona.edu/kyoto_short_courses

For the information about the College of Optical Sciences, please refer to the following web site.

http://www.optics.arizona.edu/

If you like to register by phone, please contact

Ms. Megumi Goto
Sales division, Nalux Co., Ltd.
2-1-7 Yamazaki, Shimamoto-chou, Mishima-gun, Osaka 618-0001
Tel: 075-963-3456 Fax: 075-963-3450

Wire Transfer

Three fields are required to process wire transfers through the Bank of Tokyo-Mitsubishi:

Beneficiary Bank	Tokyo-Mitsubishi-UFJ Bank (Code 0005)
Beneficiary Branch	Tenroku branch (Code 039)
Account#	4652009
Account holder	

Nalux-kabushikigaisya-arizonadaigaku-kougakusemina-guchi

This is a Japanese bank account maintained for the University of Arizona by NALUX.

Inquires

For questions regarding the hotel, registration, and money transfer (in Japanese):
Ms Goto Megumi goto@nalux.co.jp 075 963 3456

For technical questions regarding the courses (in Japanese):
Mr Onishi Michihisa onishi@nalux.co.jp

For technical questions regarding the courses (in English):
Prof. Russell Chipman russell.chipman@optics.arizona.edu 1 520 626 9435

Additional information is also available on the course website.

http://www.optics.arizona.edu/kyoto_short_courses