Day 1—Digital Projector Optical System Overview

- Light Sources: Mercury and Xenon
  - Lamp Operating Parameters
  - Spectral Output of Hg and Xe Lamps
  - Xe Bulbs
- Illumination Systems
  - Illumination System Types and Characteristics
  - Light Engine Illumination Layouts for Different Modulators
  - Illumination System Component Parts, Name, Function, Operation
  - Example Layouts of DMD, LCD, LCoS Illumination Systems
  - Illumination System Tradeoff Matrix
- Spatial Light Modulators: DMD, LCD, LCoS
  - Reflective SLM's, Performance Parameters, Issues
  - SLM Function in Illumination System
  - Example Reflective SLM - DMD Layout
  - Polarization SLM's, Performance Parameters, Issues
  - Transmissive Polarization SLM
  - Reflective Polarization SLM
  - Example Reflective Polarization SLM - LCoS Layout
  - Aperture Ratio
  - SLM Tradeoff/Comparison Matrix
- Imaging and Mapping Systems
  - Transforms from Object Plane to Image Plane
  - First Order Optical Imaging Properties: Magnification, FOV, OAL, EFL, etc.
  - Human Visual System
  - Tilted Object and Image Planes
  - Modulator Offset: Definition, Performance Costs & Benefits
  - Projection Lens Performance Parameters, Specification
  - Image Keystone: Cause and Correction
- Optical System Performance
  - Definition & Discussion of Etendue
  - Throughput Calculation Examples - Light from Bulb to Screen
  - Full Projector Throughput Calculation
  - Sequential Color Filter Time Average Transmission
- Projector System Measurement and Testing
  - Screen Lumens, Total Lumens, Illumination Uniformity Testing & Measurement
  - Solid Angle and Projected Solid Angle
  - Color Chromaticity & Chromaticity Uniformity
  - Contrast Measurement: ANSI & JBMA

- Color Convergence
- Projection Bulb Performance Measurements
- Distortion, Field Curvature, Resolution, MTF, etc.

Day Two - DLP Illumination System Layout, Design and Analysis

- Applied Digital Projector Design and Analysis (ADPD) Overview and Objectives
- Create ray file of Hg lamp with reflector
- Verify ray file is performing as expected
- Discuss home built arc model of volume emitter
- Design UV/IR filter substrate
- Design sequential RGBW filter wheel
- Design hollow integrating rod
- Perform integrating rod analysis – length vs. uniformity and transmission
- Layout of illumination system magnification and conjugate plane orientations
- Design condenser lens assembly and analyze
- Design field lens assembly and analyze
- Design TIR prism front half and analyze
- Design TIR prism back half and analyze
- Design DMD mirrors for testing illumination system
- Create and install entrance pupil plane and diameter
- Perform illumination system ray trace and analysis
- Learn and write Zemax programs to automate and optimize illumination designs
- Review Day Two Accomplishments

Day Three—DLP Imaging System Layout, Design and Analysis

- Discuss day two objectives and short review and questions of day one
- More illumination system ray trace and analysis
- Create array of DMD mirrors with proper tilt angles, size and spacing
- Perform analysis with tilts for DMD on and off states
- Learn how to create specialized MEMS modulators
- Perform illumination system ray trace and analysis.
- Insert a pre-designed catalog projection lens assembly
- Show layout in sequential ZEMAX® and perform analysis
- Create projection lens in non-sequential ZEMAX®
- Perform illumination system analysis on projection screen

- Perform imaging analysis on projection screen from DMD to screen
- Show how to create different analysis screens for example: ANSI contrast, test rectangles, resolution charts, colored grids, etc.
- Perform system test ray tracing such as contrast, uniformity, MTF
- Do some limited scattered light analysis on the system
- Perform a few system perturbations
- Review Day Three Accomplishments

Day Four—LCOS Light Engine Layout, Design, and Analysis

- Discuss day three objectives and short review and question from previous days
- Learn and perform 3 color ray tracing techniques
- Perform a system layout for a 3 panel LCOS light engine
- Learn and implement dichroic coatings and design dichroic filters
- Perform absolute and relative positioning schemes in system designs
- Learn and create X-Cube beam splitter/combiner design techniques
- Create and use polarized sources for ray tracing
- Learn how to create and test polarizing beam splitters
- Learn how to develop optical test station models using Zemax®
- Learn to create LCOS modulators
- Perform illumination system analysis on LCOS light engine

NOTE: This is a list of the sections and some of the main topic of each section, naturally the course DVD goes into greater detail on these subjects and their interactions and performance in a digital projector.