**DIGITAL CINEMA ENVIRONMENT (PROJECTORS AND DISPLAYS) CALIBRATION AND IMAGE QUALITY EVALUATION USING SMPTE AND ISO INTERNATIONAL STANDARDS**

**COURSE INSTRUCTOR:**
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**SHORTCOURSE DESCRIPTION:**
The digital cinema environment – the umbrella of the projector, portal, screen, ambient light, and cinema architecture – is examined from the invention of cinematography to the present, in relation to the spectator's perception. Practical methods of measurement, calibration, and image quality evaluation of digital cinema projectors and displays using ISO and SMPTE international standards and test images are explained.

First, the course demonstrates new guidelines for faster, simpler, and more precise luminance and chrominance measurement using a photospectro radiometer, DCP player, and D-Cinema 4K display. Next, we describe the calibration principles of the D-Cinema projector using P7 color space correction. Secondly, we provide an overview of techniques for the determination of measured photometric and colorimetric deviations from the ISO and SMPTE standards with several tools for advanced graphical analysis (ADA) using polarograms and CIEDE2000 formula to better understand specific cinema low level light conditions.

Finally, we practically demonstrate an application of the Digital Cinema Package (DCP) player software installed on the powerful laptop with CUDA GPU and connected to the non-dedicated portable universal player through dual HD-SDI outputs, that enables motion picture playback into the D-Cinema projector or display in 4K resolution.
BENEFITS:

- Understand the complexity and terminology of the digital cinema environment and learn about its similarity to the analog 35mm film projection in cinema history context.
- Measure luminance and colorimetric coordinates deviation from the reference projector or display and evaluate quality of the measuring device.
- Apply digital cinema projector and display calibration process step-by-step.
- Learn the techniques for objective and subjective image quality evaluation of the projector or display using ISO and SMPTE standard image tests for digital cinema, including advanced graphical analysis of the measured data.
- Distinguish strengths and weaknesses of the digital cinema projectors and displays with different manufacturer’s technologies.

INTENDED AUDIENCE:

Anyone interested in Digital Cinema projection or imaging on display in environments optimized for mesopic vision in low light-level conditions. Students, researchers, color grading artists, filmmakers, cinema operators, and other users who want to apply SMPTE and ISO standards and image tests for digital cinema measurement, calibration, and image evaluation for the production of superior imaging experiences.
BIOGRAPHY OF THE INSTRUCTORS:

Miloslav Novák graduated from Film Academy of Miroslav Ondricek where he received his Dipl Tech and continued his studies at the Faculty of Arts of Charles University in Prague. He received his MA (2008) in documentary filmmaking at the Academy of Performing Arts in Prague after graduating their editing department (2002). Since 2011, he has been teaching audiovisual technology and restoration at the Silesian University in Opava and at the Academy of Performing Arts where he is completing his PhD study. He has been cooperating with various film and photo archives, museums, and restoration labs as the researcher, technology supervisor and restorer inland and abroad. Now he works at the Czech Technical University in Prague.

Antonín Charvát graduated the Faculty of electrical engineering of the Czech Technical University with a MSc (1986) in cybernetic and computers. He dedicated his career to the field of image technologies (displays, printing, photo, and video facilities, as well as digital cinema). Now he is director of the EIZO Group in the Czech Republic and Slovakia. He has given workshops focused on color management and image technologies in different higher educational programs at various Czech and Slovak schools. There he prepared and tested different image technology postproduction workplaces for students.

Karel Fliegel received his MSc and PhD degrees in 2004 and 2011, both in electrical engineering and radioelectronics, from the Czech Technical University in Prague. Now he is an assistant professor with the Multimedia Technology Group. His research interests include image and video processing, compression, digitization or imaging systems.