Riga Technical University

Effective Lighting

Coordinator Leonids Ribickis

Leonids Ribickis
Ilja Galkins
Gintautas Tamulaitis
Arif Pashayev
Bahadur Tagiyev
Kerim Allahverdiyev
Igors Uteshevs
Aleksandrs Suzdalenko
Ansis Avotins
Olegs Tetervenoks

RTU Press
Riga, 2015

This document has been prepared by the financial support of European Union. Authors from Riga Technical University, National Aviation Academy and Vilnius University are responsible for the content of this document. This publication reflects the views only of the authors, and it cannot be regarded as the European Union's official position.

The book is developed in a frame of the project "Development of Training Network for Improving Education in Energy Efficiency" acronym: ENERGY, grant Nr. 530379-TEMPUS-1-2012-1- LVTEMPUS-JPCR.

The project was approved by the European Commission in frame of the Program Tempus IV – Fifth call for proposals (Programme guide EACEA/25/2011).

The textbook is devised for students of electrical engineering specialties, who study effective lighting technologies. The textbook can be useful for students and professionals focusing on lighting issues. The book gives overview of current lighting systems and elements, as well as explains their operating principles.

Sub-programme Joint Projects
Action Curricular Reform
Deliverable 2.1. Development and translation of study courses within the frame of direction Effective Lighting.
Reviewers: **Olga Ruban,** PhD, ass. Prof., Tallin University of Technology Virumaa College,
Jelena Armas, PhD, Elektriveli OÜ
Kristīne Bērziņa, Dr.sc.ing., EEF, Riga Technical University

Project Scientific Manager **Leonids Ribickis**
Project Manager **Anatolijs Zabasta**
Scientific Editors: **Ansis Avotins, Igors Uteshevs**
Proofreading **Anastasia Zhiravetska**
Coordinator institution **Riga Technical University**

ISBN 978-9934-10-603-3

Published by RTU Press, Riga Technical University, 1 Kalku Street, Riga, LV-1658, Latvia.
Cover picture from Shutterstock.com
Printed by RTU Printing House

Contributors

Leonids Ribickis (Project Coordinator), Prof., Dr. habil.sc. ing., Riga Technical University (RTU), Faculty of Power and Electrical Engineering, Institute of Industrial Electronics and Electrical Engineering, 1, Kalku Str., Riga, LV 1658, Latvia, Leonids.Ribickis@rtu.lv

Ilja Galkins, professor, Riga Technical University, Faculty of Power and Electrical Engineering, Institute of Industrial Electronics and Electrical Engineering, 12-K1, Azenes Str., Riga, LV1050, Latvia, e-mail: gia@eef.rtu.lv

Gintautas Tamulaitis, professor and head of the Department of Semiconductor Physics at Vilnius University, Sauletekio al. 9 - III, Vilnius, LT-10222, Lithuania, e-mail: gintautas.tamulaitis@ff.vu.lt

Arif Pashayev, professor, Academician of the Azerbaijan National Academy of Sciences, Rector of the National Aviation Academy of Azerbaijan, Bina 25th km, Baku 1045, Azerbaijan.

Bahadur Tagiyev, professor, Academician of the Azerbaijan National Academy of Sciences, Director of the Scientific Research Institute for Transportation and Aviocosmic Problems, National Aviation Academy of Azerbaijan, Bina 25th km, Baku 1045, Azerbaijan, e-mail: bahadur34@mail.ru.

Kerim Allahverdiyev, professor, Member of the European Academy of Sciences, Senior Scientific Researcher, Scientific Research Institute for Transportation and Aviocosmic Problems, National Aviation Academy of Azerbaijan, Bina 25th km, Baku 1045, Azerbaijan, e-mail: kerim.allahverdi@gmail.com

Igors Uteshevs, senior researcher, Riga Technical University, Faculty of Power and Electrical Engineering, Institute of Industrial Electronics and Electrical Engineering, 12-K1, Azenes Str., Riga, LV1050, Latvia, e-mail: igors.utesevs@rtu.lv

Aleksandrs Suzdalenko, senior researcher, Riga Technical University, Faculty of Power and Electrical Engineering, Institute of Industrial Electronics and Electrical Engineering, 12-K1, Azenes Str., Riga, LV1050, Latvia, e-mail: aleksandrs.suzdalenko@rtu.lv

Ansis Avotins, researcher, Riga Technical University, Faculty of Power and Electrical Engineering, Institute of Industrial Electronics and Electrical Engineering, 12-K1, Azenes Str., Riga, LV1050, Latvia, e-mail: ansis.avotins@rtu.lv

Olegs Tetervenoks, researcher, Riga Technical University, Faculty of Power and Electrical Engineering, Institute of Industrial Electronics and Electrical Engineering, 12-K1, Azenes Str., Riga, LV1050, Latvia, e-mail: olegs.tetervenoks@rtu.lv

Contents