Syllabus

Course Program

"Automation in production and devices for environmental control and monitoring."

Specialty
101 – Ecology

Institute
Institute of Computer Modeling, Applied Physics and Mathematics

Educational program
Engineering Ecology

Department
Automation of Technological Systems and Environmental Monitoring (174)

Level of education
Master's level.

Course type
Selective

Semester
2

Language of instruction
English, Ukrainian

Lecturers and course developers

Roman Mykhailovych Vorozhbiian
Email: Roman.Vorozhbiian@khpi.edu.ua
PhD, Associate Professor, Associate Professor at the Department of Automation of Technological Systems and Environmental Monitoring.
Total number of publications: 40.
Work experience: 8 years.
Main courses taught:
Installation, Repair, and Adjustment of Automation Devices and Means.
Automation of Production and Environmental Monitoring Devices.
Control and Management of Chemical-Technological Processes.
For more detailed information about the instructor, please refer to the department's website.
https://web.kpi.kharkov.ua/acem/uk/welcome/

General information

Summary

The discipline enables students to independently and creatively solve problems related to the automation of production, methods and schemes of automation, functional capabilities of devices, and the placement of technical equipment. The main objectives of the study are to provide students with the opportunity to learn metrological characteristics, methods of measuring temperature, pressure, flow, level, composition, and quality of substances.

Course objectives and goals

The formation of the fundamentals of environmental control and monitoring in the context of automation systems. Providing knowledge about technical means of measurement in environmental industrial

processes, general principles of constructing functional automation schemes, and the selection of channels for regulating technological parameters based on various technical means..

Format of classes

Lectures, laboratory work, independent work, consultations, and a final assessment through an exam.

Competencies

The ability to perform work on the construction of automation systems for technological processes in terms of measures to ensure environmental safety and the use of modern methods for monitoring the environment. Additionally, using automation and control means for environmental indicators.

Learning outcomes

Knowing the basic tools and methods for controlling technological parameters and environmental indicators and being able to choose and use means of automated control and management of technological processes and devices for environmental control and monitoring.

Student workload

The total scope of the discipline is 120 hours (4 ECTS credits): lectures – 32 hours, laboratory work – 16 hours, independent work – 72 hours.

Course prerequisites

To successfully complete the course, it is necessary to have knowledge and practical skills in the following disciplines: "Equipment and Basics of Designing Environmentally Safe Technologies Using CAD.

Features of the course, teaching and learning methods, and technologies

Lectures are conducted interactively using multimedia technologies. During laboratory sessions, students reproduce and observe the flow of certain processes and find ways to optimize process parameters. Educational materials are available to students on the department's website and the scientific and technical library website of the NTU "KhPI" at http://library.kpi.kharkov.ua/..

Program of the course

Topics of the lectures

Topic 1. Introduction. General information about automation in production and instruments for environmental control and monitoring.
Topic 2. Metrological fundamentals and measurement basics.
Topic 3. Methods and instruments for pressure measurement.
Topic 4. Methods and instruments for temperature measurement.
Topic 5. Methods and instruments for measuring the flow of steam, gas, and liquids.
Topic 6. Methods and instruments for level measurement.

Topics of the workshops

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Topics of the laboratory classes

Lab Work 1. Adjustment and testing of an electrocontact pressure gauge at specified pressure conditions.
Lab Work 2. Measurement of the level using a buoyancy level gauge with Sel'syn transmission to a secondary device.
Lab Work 3. Graduation of a resistance thermometer.
Lab Work 4. Verification of the temperature scale graduation of a logometer.
Lab Work 5. Verification of the temperature scale graduation of electronic automatic bridges.
Lab Work 6. Measurement of oxygen concentration with an automatic thermomagnetic gas analyzer.
Lab Work 7. Measurement of liquid flow using the constant pressure drop method.
Lab Work 8. Measurement of the level of a differential manometer with pneumatic transmission.

Self-study

The course includes the completion of an individual computational task, with the results presented in a written report. Students are also recommended additional materials (videos, articles) for self-study and analysis.

Course materials and recommended reading

1.Love, Jonathan Process automation handbook : a guide to theory and practice 1. Process control 2.Automation I. Title 670.4'27 ISBN-13: 9781846282812 ISBN-10: 1846282810 Library of Congress Control Number: 2007927990 ISBN 978-1-84628-281-2 e-ISBN 978-1-84628-282-9 Printed on acid-free paper c Springer-Verlag London Limited 2007
2.Dunn, William C. Introduction to instrumentation, sensors, and process control. —(Artech House sensors library) 1. Engineering instruments 2. Electronic instruments 3. Process control I. Title 681.2 ISBN-10: 1-58053-011-7 Cover design by Cameron Inc. 2006
3.Lessons In Industrial Instrumentation c 2008-2022 by Tony R. Kuphaldt – under the terms and conditions of the Creative Commons Attribution 4.0 International Public License
4.George Stephanopoulos – Chemical Process Control: An Introduction to Theory and Practice. Prentice Hall Int. Series in the Physical and Chemical Engineering Sciences (1984)
5.William C. Dunn. Fundamentals of Industrial Instrumentation and Process Control. McGraw-Hill eBook, 2005, 337 p. DOI: 10.1036/0071466932
6.Process systems analysis and control.—3rd ed. / Donald R. Coughanowr, Steven E. LeBlanc. p. cm.—(Mcgraw-Hill chemical engineering series) Includes index. ISBN 978–0–07–339789–4—ISBN 0–07–339789–X (hard copy : alk. paper) 1. Chemical process control. I. LeBlanc, Steven E. II. Title. TP155.75.C68 2009
7.Process control : a practical approach / Michael King. p. cm. Includes bibliographical references and index. ISBN 978-0-470-97587-9 (cloth) 1. Chemical process control. I. Title. TP155.75.K56 2011 660'.2815–dc22
8.Process Control Instrumentation Technology Curtis D. Johnson Eighth Edition Edinburgh Gate Harlow Essex CM20 2JE England and Associated Companies throughout the world Visit us on the World Wide Web at: www.pearsoned.co.uk © Pearson Education Limited 2014

Assessment and grading

Criteria for assessment of student performance, and the final score structure

100% of the final grade consists of evaluation results, including exams and current assessment. Pass/Fail: 2 quizzes (20% each); laboratory workshop (30%), and computational task (30%).

Grading scale

Total points	National	ECTS
90–100	Excellent	A
82–89	Good	B
75–81	Good	C
64–74	Satisfactory	D
60–63	Satisfactory	E
35–59	Unsatisfactory (requires additional learning)	FX
1–34	Unsatisfactory (requires repetition of the course)	F

Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.
Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

Approval

Approved by	Date, signature	Head of the department Oleksandr DZEVOCHKO
	1.08. 2023 	Guarantor of the educational program Musii Tseitlin