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DEBSEUz

**MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATION OF THE REPUBLIC OF UZBEKISTAN**

**TIIAME National Research University**

TIIAME NRU

**«APPROVED»**

**Vice-Rector for Academic Affairs**

**_____ B.A. Xudayarov**

**"____" _____2025**

# «TRAINING COURSE ON RENEWABLE ENERGY SYSTEMS»

# SYLLABUS FOR THE SHORT-TERM COURSE

DEBSEUz Training Center – Renewable Energy Sources

Total: 30 hours - 5 days (6 hours per day)

**TASHKENT– 2025**

TIIAME NRU

**Module / Course Syllabus**
**Faculty of Energy**

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|---|---|
| **Course name:** | **Renewable Energy Systems (Short-Term Training Course)** |
| **Type of course:** | Intensive / Professional Development |
| **Course code:** | RES-TC-2025 |
| **Year:** | - |
| **Type of study:** | Full-time, 5-Day Intensive |
| **Total hours:** | 30 hours |
| Lecture | 14 hours |
| Practical class | 10 hours |
| Laboratory | 6 hours |
| **Assessment Type:** | Written Test + Practical Presentation |
| **Language of study:** | English / Uzbek (depending on group) |

| **Course Objective (CO)** | |
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| **CO1** | The purpose of this short-term vocational training program is to provide participants with important theoretical knowledge and practical skills in renewable energy sources.<br>The course aims to introduce participants to modern solar, wind, microHPP, hybrid and energy storage technologies; develop the ability to analyze renewable energy potential; design basic PV and wind systems; perform laboratory measurements and safety procedures related to renewable energy systems. |

| **Learning Outcomes (LO)** | |
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| | After completing the course, trainees will be able to: |
| **LO1** | Understand the basic structure and development of renewable energy in Uzbekistan.<br>Identify the main types of renewable energy sources and their operational principles.<br>Analyze solar radiation parameters and assess regional renewable energy potential.<br>Design and calculate photovoltaic systems (module sizing, inverter selection, battery capacity).<br>Perform laboratory measurements on PV modules, batteries, and wind turbines. |

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| | Explain energy storage principles and evaluate grid integration challenges.<br>Develop a mini-hybrid system design using solar and wind energy resources.<br>Apply maintenance, safety and troubleshooting procedures in renewable energy systems. |

## Course schedule (Calendar-based)

| № | Types of training | Topic title and its summary | Dedicated hours | Teacher's signature |
|---|---|---|---|---|
| **DAY 1 — INTRODUCTION & ENERGY OVERVIEW (6 hours)** | | | | |
| 1 | Lecture session | Introduction. History of the development of energy. Energy system of the Republic of Uzbekistan. Concept of the development of energy of Uzbekistan. | 2 | |
| 2 | Lecture session | Renewable energy sources: types, operating principles and global development trends. The role of renewable energy in climate change. | 2 | |
| 3 | Practical session | Assessment of the potential of renewable energy sources using modern programs | 2 | |
| **DAY 2 — SOLAR POWER (6 hours)** | | | | |
| 4 | Lecture session | Solar radiation (DNI, GHI&GTI, DHI) & Measurement Methods. Measuring solar radiation and determining the efficiency of a photovoltaic module. Obtaining the Volt-Ampere characteristics of a solar module, connecting solar modules in series and parallel. Solar PV system components and operation. Solar collector. | 2 | |
| 5 | Laboratory session | Solar Radiation Measurement & PV Module Efficiency Testing | 2 | |
| 6 | Practical session | Calculation and selection of PV modules for a solar power plant. Calculation of the number of batteries and selection of their type. | 2 | |
| **DAY 3 — WIND POWER and HYDRO POWER PLANT (6 hours)** | | | | |
| 7 | Lecture session | Wind and its formation. Instruments measuring wind speed. Wind power plant, components and operation | 2 | |

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|---|---|---|---|---|
| 8 | Lecture session | Types of small-capacity and microHPPs and their advantages. Calculation of the capacity of small hydropower plants. | 2 | |
| 9 | Laboratory session | Wind Turbine Laboratory – Power Curve Determination | 2 | |
| **DAY 4 — ENERGY STORAGE SYSTEM & GRID INTEGRATION (6 hours)** | | | | |
| 10 | Lecture session | Energy storage systems and integration of alternative energy sources into main grid. | 2 | |
| 11 | Laboratory session | Measuring the charge-discharge characteristics of a battery. | 2 | |
| 12 | Practical session | Design of hybrid solar–wind-ESS power supply scheme | 2 | |
| **DAY 5 — PROJECT DEVELOPMENT & FINAL ASSESSMENT (6 hours)** | | | | |
| 13 | Lecture session | Safety, Maintenance & Best Practices in Renewable Energy Systems. Design and calculation of solar energy systems. Energy production forecast and efficiency analysis. LCOE (Levelized Cost of Energy) and economic efficiency assessment. | 2 | |
| 14 | Practical session | Mini project: Designing a small PV/wind power system | 2 | |
| 15 | Assessment | Final exam & group presentations | 2 | |
| **Total** | | | **30** | |

## ASSESSMENT PROCEDURE FOR SHORT-TERM TRAINING COURSE

**Assessment and Monitoring of Participant Performance.**

Assessment within this short-term training course is carried out based on participants' performance in practical tasks, laboratory activities, and the final project presentation.

Since the program is not part of the credit-module academic system, midterm examinations are not required. Instead, evaluation is focused on skills acquisition and competence demonstration. The total score for the course is 100 points, distributed across practical performance, laboratory work, and the final assessment. Participants must earn at least 60 points to successfully complete the training and receive a certificate.

## Types of Assessment (Adapted for Training Course)

| | Type of Evaluation | Maximum score | Passing score |
|---|---|---|---|
| 1 | Practical & Laboratory Performance | 40 | 24 |
| 2 | Mini-Project (System Design Task) | 30 | 18 |
| 3 | Final Test (20 questions) | 30 | 18 |
| | **Total** | 100 | 60 |

- Participation in practical and laboratory sessions – 20 point;
- Completion of hands-on laboratory tasks – 20 points;
- Mini project: System design, calculations, and justification – 30 points;
- Final written test (20 multiple-choice questions) – 30 points.

| № | Main References |
|---|---|
| 1. | D.H. MacKay, *Sustainable Energy – Without the Hot Air*, UIT Cambridge Ltd., 2020. |
| 2. | A.M. B. Shafiee, *Renewable Energy Sources: Engineering, Technology, and Management*, Springer, 2022. |
| 3. | M.T. H.N. Alazhari, *Renewable Energy Systems: A Smart Energy Systems Approach to the Next Generation of Power*, Wiley, 2021. |
| 4. | International Renewable Energy Agency (IRENA), *Renewable Power Generation Costs in 2022*, 2022. |
| 5. | J.L. P. C. Baptista et al., "The Role of Renewable Energy in Sustainable Development: A Review," *Renewable and Sustainable Energy Reviews*, vol. 138, Article 110622, 2021. |
| 6. | Giovanni Riva, Ester Foppapedretti. Handbook on renewable energy sources. Italy. 2012 |
| 7. | International Energy Agency (IEA) - World Energy Outlook |
| 8. | PVsyst User Manuals |
| 9. | Masdar & ACWA Power Technical Reports |
| 10. | Global Solar Atlas and Global Wind Atlas |
| 11. | Uzbekistan Ministry of Energy - Strategy Documents |
| 12. | DEBSEUz Project Training Materials |
| 13. | Majidov T.SH. Noana'naviy va qayta tiklanuvchi energiya manbalari. O'quv qo'llanma, -Toshkent, 2014. |
| 14. | Твайделл Д.,Уэйр А. Возобновляемые источники энергии.– М.:Энергоатомиздат, 1990. |

| Additional References | |
|---|---|
| **15.** | Мирзиёев Ш.М. Эркин ва фаровон, демократик Ўзбекистон давлатини биргаликда барпо этамиз. Ўзбекистон Республикаси Президентининг лавозимига киришиш тантанали маросимига бағишланган Олий Мажлис палаталарининг қўшма мажлисидаги нутқи. –Т.: «Ўзбекистон» НМИУ,2016-56б. |
| **16.** | Мирзиёев Ш.М. Буюк келажагимизни мард ва олийжаноб халқимиз билан бирга қурамиз. –Т.: «Ўзбекистон» НМИУ, 2017. - 488 б. |
| **17.** | Ўзбекистон Республикасини янада ривожлантириш бўйича Ҳаракатлар стратегияси тўғрисида. –Т.: 2017 йил 7 февраль, ПФ– 4947–сонли Фармони. |
| **Internet resources** | |
| **18.** | http://www.awea.org – The American Wind Energy Association |
| **19.** | http://www.ewea.org – The European Wind Energy Association |
| **20.** | http://acre.murdoch.edu.au/ –The Australian Renewable Energy Website |
| **21.** | https://staff.tiiame.uz/teacher/748/books Official website of the NRU "Tashkent Institute of Irrigation and Agricultural Mechanization Engineers (TIIAME)". |

## INFORMATION ABOUT THE COURSE INSTRUCTOR

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This syllabus was approved by the minutes of the University Council meeting No. __, dated _____, 202_

The syllabus was approved by the minutes of the Faculty of Energy Council meeting No. ___ dated _____, 202_

This syllabus was approved by the minutes of the Department of "Power Supply and Renewable energy sources" meeting No. ___ dated _____, 202_

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