«APPROVED»
Vice Rector for Research and Innovation
_____ Sh.M. Davlyatov
"30" 08 2025-year

IMPLEMENTATION OF THE CALENDAR AND MATERIALS FOR THE TRAINING COURSE ON SOLAR ENERGY ENGINEERING

(Lecture session, laboratory and practical sessions, 30 hours in total)

1. DISTRIBUTION OF SUBJECTS AND TOPICS

1) Solar thermal devices and systems.

№	Types of training	Topic title and its summary	Dedicated hours	Teacher's signature
1	Lecture session	Solar collector typologies and definition of efficiency. Thermal balance of a solar collector and analysis of temperature profile of the plate. Hottel equation. Thermal and optical characterization of plate, glazed cover, ducts, and insulation. Economic benefits and cost analysis	2	
2	Lecture session	Passive solar heating systems: Fundamentals of passive Solar heating; Design Strategies for passive Solar heating; Key components of passive Solar design; Types of passive Solar heating systems; Economic benefits and cost analysis	2	
3	Practical session	Convective heat transfer during flow in pipes and channels. Convective heat transfer under forced convection conditions. Heat and mass transfer processes in solar water heaters. Methods for optimizing the thermal, geometric, optical characteristics of the main components of solar water heaters. Heat and mass transfer processes in solar dryers. Natural and forced convection processes in solar dryers.	2	
Total			**6**	

2) Optical and physical properties of semiconductor materials.

№	Types of training	Topic title and its summary	Dedicated hours	Teacher's signature
1	Lecture session	Contact phenomena: metal–semiconductor contact, p-n junctions, heterojunctions. Optical properties of semiconductors: absorption and reflection spectra, excitons. Optical and photoelectric devices	2	
2	Practical session	Optical properties of semiconductors: absorption and reflection spectra, excitons. Photoelectric	2	

		phenomena: photoconductivity, photovoltaic effects, Schottky barrier. Optical and photoelectric devices: LEDs, semiconductor lasers, photodiodes, phototransistors		
3	Laboratory session	Luminescence in semiconductors: types, mechanisms, spontaneous and stimulated emission. Optical properties of semiconductors: absorption and reflection spectra, excitons. Optical and photoelectric devices: LEDs, semiconductor lasers, photodiodes, phototransistors.	2	
Total			**6**	

3) Generation, transmission and distribution of electricity.

№	Types of training	Topic title and its summary	Dedicated hours	Teacher's signature
1	Lecture session	Alternative energy sources: types and main characteristics. Transmission of electricity generated from alternative energy sources.	2	
2	Lecture session	Integration of alternative energy sources in power grids. Smart Grid and alternative energy.	2	
3	Practical session	Modeling the process of transmitting electricity to consumers in alternative energy systems. Calculation of the connection possibilities of alternative energy sources in electrical networks.	2	
Total			**6**	

4) Design of energy devices and stations based on alternative energy sources.

№	Types of training	Topic title and its summary	Dedicated hours	Teacher's signature
1	Lecture session	Selection of site and shadow analysis. Selection of PV module (cells and BOM) and sizing. Selection and sizing of Aux. transformer and Aux. Losses calculation. Calculating the Energy Yield for a PV Grid-Connected System. Troubleshooting. Costing and tendering of solar power plant.	2	
2	Practical session	Calculation of Protective Angles and Zone of Protection for Various. Specific Yield and Performance Ratio.	2	
3	Laboratory session	Calculation and design of a solar power plant for a given region. Designing a small wind farm. Designing hybrid power plants	2	
Total			**6**	

5) Energy storage methods and devices.

№	Types of training	Topic title and its summary	Dedicated hours	Teacher's signature
1	Lecture session	Forms of energy accumulation. Heat energy storage systems. Energy accumulation using hydraulic accumulation power plants. Inductive energy storage systems. Current and future opportunities for electricity storage system.	2	
2	Practical session	Modeling of energy storage systems using MATLAB and Simulink. Design of heat storage systems. Analysis of experiments on latent heat-insulating materials	2	
3	Laboratory session	Laboratory analysis of the hydrogen production and storage system. Measurement and analysis of the parameters of mechanical energy storage systems. Analysis of the operating condition of hydraulic accumulation power plants.	2	
Total			6	

2. LESSON SCHEDULE AND DISTRIBUTION

	Day-1	Day-2	Day-3	Day-4	Day-5
Courses / **Pairs**	Solar thermal devices and systems	Optical and physical properties of semiconductor materials	Generation, transmission and distribution of electricity	Design of energy devices and stations based on alternative energy sources	Energy storage methods and devices
I	Lecture session	Lecture session	Lecture session	Lecture session	Lecture session
II	Lecture session	Practical session	Lecture session	Practical session	Practical session
III	Practical session	Laboratory session	Practical session	Laboratory session	Laboratory session

Head of the department **A.A. Kuchkarov**