



National Technical University of Ukraine “Kyiv Polytechnic Institute”

SPECIFICS OF EDUCATION AT THE DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

KYIV, May 2021

UNIVERSITY MISSIONS

POST-DIPLOMA TRAINING – 2 YEARS

DOCTOR OF SCIENCES – 3 YEARS

PhD (Candidate of Sciences) – 3 YEARS

MASTERS DEGREE – 2 YEARS

BACHELORS DEGREE – 4 YEARS

PRE-UNIVERSITY TRAINING – 1 YEAR (optional)



DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

Highly educated professionals from nuclear industry, research centers and regulatory body are involved into the teaching of the basic disciplines.

Currently, staff of NPP & ETP Department includes:

- professors – 5,**
- associated professors – 8,**
- senior teachers – 4,**
- professor`s assistants – 14,**
- scientists – 18.**

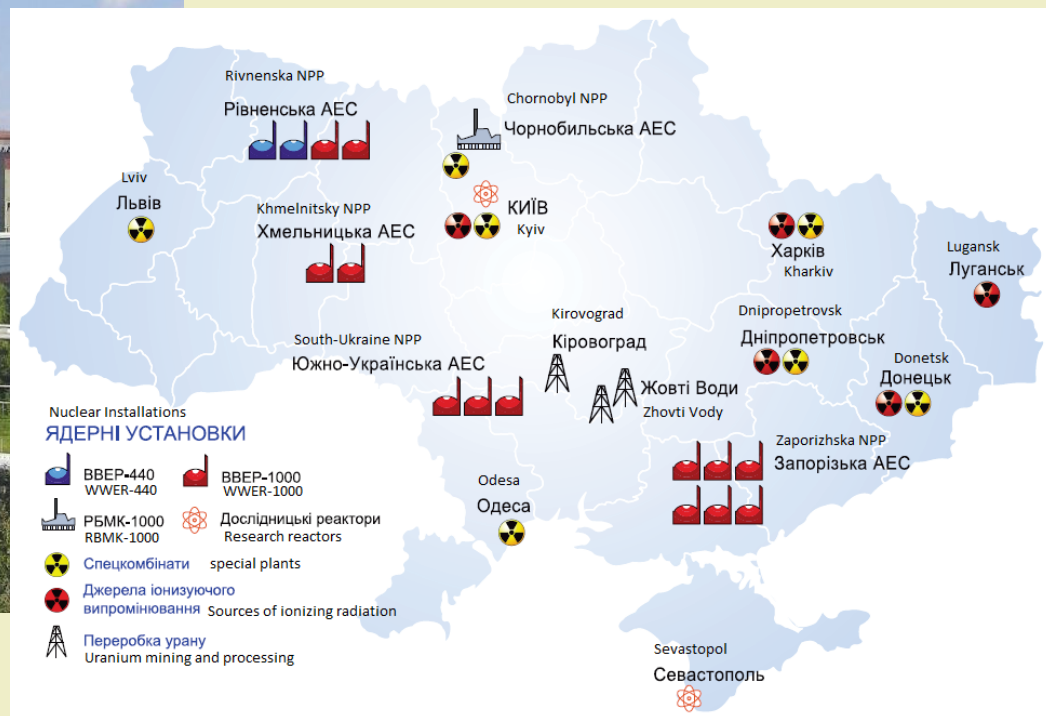
There are about 500 students at the Department.

Totally about 13000 engineers graduated from the Department since 1903.



DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

**Our Department is a leader in education of engineers
for Nuclear Power Plants in Ukraine**





DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

Specializations of the Department:

- **Nuclear Energy**
- **Boilers and Reactors**
- **Nuclear Security**



DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

**The main directions of education and scientific work
for master program "Nuclear Energy":**

- **Operation of nuclear installations**
- **Construction and decommissioning, maintenance and repair of nuclear installations**
- **Modeling of neutron-physical and thermohydraulic processes**
- **Reliability and safety of nuclear installations**
- **Accident management**
- **Safety culture at NPP**
- **Risk management**

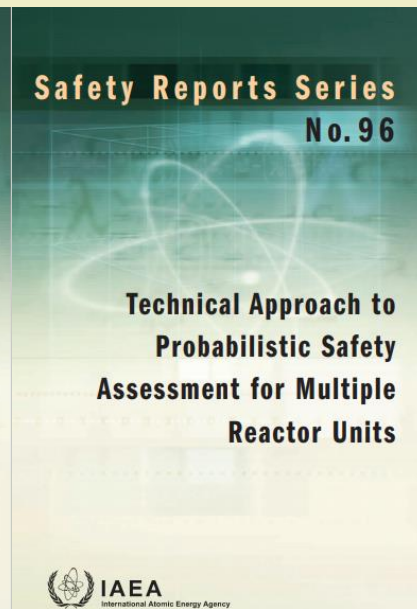
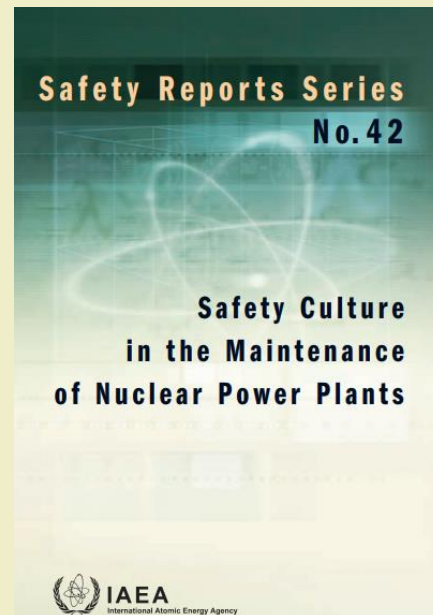




DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

“Nuclear Energy” specialization includes the following professional educational disciplines:

- **Introduction to the Specialty**
- **Nuclear Power Reactors**
- **Theory of Nuclear Reactors**
- **Atomic and Quantum Physics**
- **Nuclear and Neutron Physics**
- **Nuclear and Heat Power Plants**
- **Operation of Nuclear Power Plants**
- **Heat and Mechanical Equipment of NPP**
- **Pumps of NPPs**
- **Materials for NPP**
- **Non-Stationary Processes and Control of Nuclear Installations**
- **Accident Processes and Safety Systems of Nuclear Power Plants**
- **Probabilistic Risk Assessment of NPP**
- **Safety Culture**
- **Dosimetry**
- **Construction, Decommissioning and Decontamination of Nuclear Power Plants**





DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

“Nuclear Security” specialization includes the following professional educational disciplines:

- Introduction to Nuclear Security
- Legal, regulatory, & institutional frameworks
- Nuclear material accounting & control for security
- Developing and implementing Design Basis Threat
- Nuclear security culture
- Physical protection systems design & evaluation
- Non-Destructive Assay of Nuclear Materials
- Information and computer security
- Nuclear security management
- Legal drafting for nuclear security
- Radioactive Waste Management
- Vulnerability Assessment and Risk Management
- Preventing and protecting against insider threat
- Advanced security technologies & equipment
- Emergency & Crisis Management



FOREIGN STUDENTS



Languages of education:

- ***Ukrainian***
- ***Russian***
- ***English***

Master's degree education program on Nuclear Energy for Ankara University

- Scientific preparatory lecture courses-
1year (two semesters)
- Degree master program Nuclear Energy-
2 years (4 semesters)

Scientific preparatory lecture courses- 1year (two semesters)

Annex 2

“SCIENTIFIC PREPARATORY LECTURES” COURSES

No	Courses	ECTS Credits	Type of control	Course work	Classroom hours per week	Lectures	Practical lessons	Laboratory
1 semester								
1	Hydro-gas Dynamics	7,0	exam		5	3	1	1
2	Heat and Mass Exchange	7,0	exam		5	3	2	
3	Theory of Nuclear Reactors -1. Diffusion and neutron deceleration.	4,0	exam		3	2	1	
4	Theory of Nuclear Reactors -2. Course work	1,0		1				
5	Education disciplines on auxiliary equipment of NPP. Pumping and auxiliary equipment of NPP.	5,0	test		4	3	1	
6	Fundamentals of Security Management in Nuclear Energy.	2,0	test		2			
7	Ukrainian (Russian) professional language professional - 1.	2,0	test		2		2	
8	Foreign language of professional orientation - 1.	2,0	test		2		2	
Total per semester:		30,0	3/3	1	23	11	9	1
2 semester								
1	Heat exchange during phase transformations and radiation.	5,0	exam		4	2	2	
2	Nuclear Power Reactors.	4,0	exam		2,5	2	0,5	
3	Nuclear and Heat Power Plants.	3,0	test		3	2	1	
4	Technology of Coolant.	4,0	test		4	3		1
5	Theory of Nuclear Reactors -3. Critical dimensions of the reactor.	5,5	exam		4	2	2	
6	Training disciplines on kinetics and control of Nuclear Reactors. Non-stationary processes and control of Nuclear Steam Production Facilities (NSPF).	4,5	exam		3,5	2,5		1
7	Ukrainian (Russian) professional language professional - 1.	2,0	test		2		2	
8	Foreign language of professional orientation - 2. Foreign language professional communication. Business language	2,0	test		2		2	
Total per semester:		30,0	3/5		25	13,5	9,5	2
Total:		60,0	6/8	1				

Scientific preparatory lecture courses- 1year (two semesters)

BİLİMSEL HAZIRLIK DERSLERİ

Sıra no	Dersler	AKTS kredileri	Sınav şekli	Sınıf çalışması	Haftalık ders saati	Teorik	Uygulama	Laboratuar
1. yarıyıl								
1	Hidro-gaz Dinamiği	7,0	yazılı sınav		5	3	1	1
2	Isı ve Kütle Transferi	7,0	yazılı sınav		5	3	2	
3	Nükleer Reaktör Teori -1. Difüzyon ve nötronun yavaşlatılması.	4,0	yazılı sınav		3	2	1	
4	Nükleer Reaktör Teori -2. Sınıf çalışması	1,0		1				
5	Nükleer Güç Santrallerinin Yardımcı Ekipmanları Hakkında Eğitim Disiplinleri	5,0	test		4	3	1	
6	Nükleer Güç Santrallerinde Pompalar ve Yardımcı Ekipmanlar	2,0	test		2			
7	Nükleer Enerjide Emniyet Yönetiminin Temelleri	2,0	test		2		2	
8	Ukraynaca (Rusça) - 1.	2,0	test		2		2	
1. Yarıyıl Toplam:		30,0	3/3	1	23	11	9	1
2. yarıyıl								
1	Faz Dönüşümü ve Radyasyon Sırasında Isı Transferi	5,0	yazılı sınav		4	2	2	
2	Nükleer Güç Reaktörleri	4,0	yazılı sınav		2,5	2	0,5	
3	Nükleer ve Isı Güç Santralleri	3,0	test		3	2	1	
4	Soğutucu Teknolojisi	4,0	test		4	3		1
5	Nükleer Reaktör Teori -3. Reaktörün Kritik Boyutları.	5,5	yazılı sınav		4	2	2	
6	Nükleer Reaktörlerin Kontrolü ve Kinetiği Hakkında Eğitim Disiplinleri	4,5	yazılı sınav		3,5	2,5		1
7	Nükleer Buhar Üretim Tesislerinin Kontrolü ve Kararlı Olmayan Süreçler	2,0	test		2		2	
8	Mesleki Ukraynaca (Rusça) - 1.	2,0	test		2		2	
2. Yarıyıl Toplam:		30,0	3/5		25	13,5	9,5	2
Toplam:		60,0	6/8	1				

Degree master program Nuclear Energy

Annex 1.

ANKARA UNIVERSITY AND NATIONAL TECHNICAL UNIVERSITY OF UKRAINE JOINT DEGREE MASTER PROGRAM WITH THESIS: NUCLEAR ENERGY COURSES AND COURSE CONTENTS

No	University	Semester	C/E	COURSES	Hours per week				ECTS
					Lecture	Practical	Laboratory	Total	
1	AU	1	C	Patenting and Intellectual Property	2	1		3	3
2	KPI	2	C	Decontamination, Repair, Assembling and Decommissioning of Nuclear Power Plants	1	1		2	3
3	KPI	2	C	Computer Aided Design Systems in Power Plants	1		1	2	3
4	KPI	2	C	Theory and Systems of Automatic Control of Nuclear Power Plants	2		1	3	2,5
5	KPI	2	C	Control and Regulation of Steam Turbine Facilities at Nuclear Power Plants	1	2		3	3
6	KPI	2	C	Analysis Methods of Risk and Reliability of Nuclear Power Plants	2		1	3	5
7	KPI	2	C	Operational Modes of Nuclear Power Plants	4		3	7	10
8	AU	1	C	Regulatory and legal support of the energy industry	2	1		3	2
9	KPI	2	C	Nuclear-Physical Methods of Reactor Nuclear Power Stations Diagnosis	3	1		4	5

Degree master program Nuclear Energy

				Station Diagnosis					
10	AU	1	C	Emergency modes and safety of nuclear power plants	3	2	2	7	7,5
11	AU	1	C	Analysis and management of accidents at nuclear power plants	2	1	1	4	6
12	AU	1	C	Energy Markets and Fuel Cycle Economics	2	1		3	4
13	KPI	2	C	Computer modeling of thermohydraulic processes in the elements of power equipment	1		2	3	6
14	AU	1	C	Heat exchange and hydrodynamics in power equipment	6			6	7
15	KPI	2,3	E	Subjects on Sustainable Development Problems	1	1		2	2
16	KPI	2,3	E	Subjects on Startup Projects Development	1	2		3	3
17	KPI	2,3	E	Practical foreign language professional communication		6		6	4,5
18	KPI	2,3	E	Pedagogy Subjects	1	1		2	2
19	KPI	2,3	E	Educational disciplines on safety in nuclear energy	2	1		3	4
20	AU	1,4	E	Advanced Reactor Physics	3			3	7
21	AU	1,4	E	Nuclear Safety and Security	3			3	7
22	AU	1,4	E	Nuclear Fuel Cycle	3			3	7
23	AU	1,4	E	Radiation Protection and Shielding	3			3	7
24	AU	1,4	E	Radiological Engineering	3			3	7
25	AU	1,4	E	Numerical Techniques 1	2	1		3	7

C: Compulsory Course, E: Elective Course

KPI: Igor Sikorsky Kyiv Polytechnic Institute (KPI), AU : Ankara University

Degree master program Nuclear Energy

Ek 1.

**ANKARA ÜNİVERSİTESİ VE UKRAYNA ULUSAL TEKNİK ÜNİVERSİTESİ
TEZLİ YÜKSEK LİSANS PROGRAMI: NÜKLEER ENERJİ
DERSLERİ VE DERS İÇERİKLERİ**

No	Üniversite	Dönem	C/E	DERSLER	Haftalık Ders Saati				AKTS
					Ders	Uygulama	Laboratuvar	Toplam	
1	AU	1	C	Patentleme ve Fikri Mülkiyet	2	1		3	3
2	KPI	2	C	Nükleer Güç Tesislerinin Arındırılması, Bakım-Onarımı, Montajı ve İşletmeden Çıkarılması	1	1		2	3
3	KPI	2	C	Nükleer Güç Santrallerinde Bilgisayar Destekli Tasarım Sistemleri	1		1	2	3
4	KPI	2	C	Nükleer Güç Sistemlerinin Otomatik Kontrol Sistemleri ve Teorisi	2		1	3	2,5
5	KPI	2	C	Nükleer Güç Santrallerinde Buhar Türbin Tesislerinin Kontrolü ve Düzenlemesi	1	2		3	3
6	KPI	2	C	Nükleer Güç Santrallerinin Risk ve Güvenilirliğinin Analiz Yöntemleri	2		1	3	5
7	KPI	2	C	Nükleer Güç Tesisleri İşletme Modları	4		3	7	10
8	AU	1	C	Enerji Endüstrisinde Mevzuat ve Yasal Dayanak	2	1		3	2
9	KPI	2	C	Reaktör Nükleer Güç İstasyonları Tanısının Nükleer-Fiziksel Yöntemleri	3	1		4	5

Degree master program Nuclear Energy

				İçerikler					
10	AU	1	C	Nükleer Güç Santrallerinin Acil Durumu Modları ve Güvenlik	3	2	2	7	7,5
11	AU	1	C	Nükleer Güç Santrallerinde Kaza Analizi ve Yönetimi	2	1	1	4	6
12	AU	1	C	Enerji Piyasası ve Yakıt Çevrim Ekonomisi	2	1		3	4
13	KPI	2	C	Güç Ekipmanlarında Termohidrolik Süreçlerin Bilgisayar Modellenmesi	1		2	3	6
14	AU	1	C	Güç Ekipmanında Isı Değişimi ve Hidrodinamikler	6			6	7
15	KPI	2,3	E	Sürdürülebilir Geliştirme Problemleri Konuları	1	1		2	2
16	KPI	2,3	E	Başlangıç Projeleri Geliştirme Konuları	1	2		3	3
17	KPI	2,3	E	Profesyonel Pratik Yabancı Dil İletişimi		6		6	4,5
18	KPI	2,3	E	Pedagoji Konuları	1	1		2	2
19	KPI	2,3	E	Nükleer Enerji Güvenliğinde Eğitim Disiplinleri	2	1		3	4
20	AU	1,4	E	İleri Reaktör Fiziği	3			3	7
21	AU	1,4	E	Nükleer Güvenlik ve Emniyet	3			3	7
22	AU	1,4	E	Nükleer Yakıt Çevrimi	3			3	7
23	AU	1,4	E	Radyasyondan Korunma ve Zırhlama	3			3	7
24	AU	1,4	E	Radyoloji Mühendisliği	3			3	7
25	AU	1,4	E	Sayısal Teknikler 1	2	1		3	7

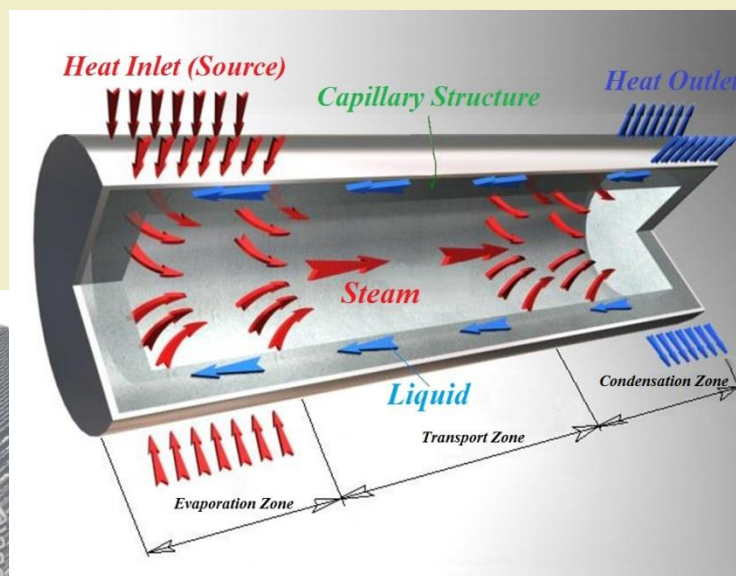
C: Zorunlu ders, E: Seçmeli ders

KPI : Igor Sikorsky Kyiv Polytechnic Institute (KPI), AU : Ankara Üniversitesi



DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

SCIENTIFIC ACTIVITIES

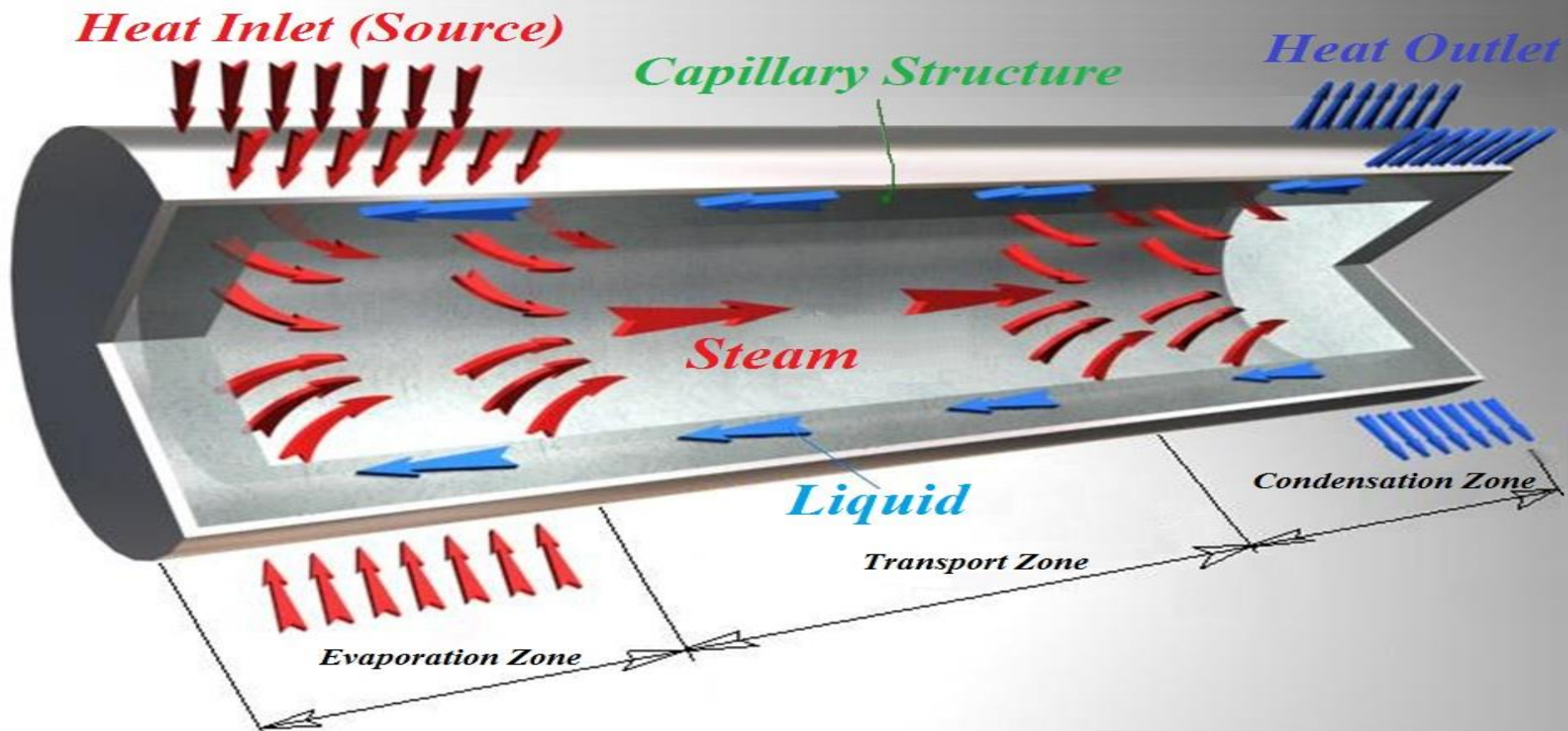




DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

Heat Pipes

is one of the leading direction of scientific activity at the Department





DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

The significant experimental data were developed during investigations of heat transfer in the fuel assemblies cooled by water under supercritical pressure.

This established the good basis for participation of our Department in the IAEA Coordinated Research Project (CRP) "Heat Transfer Behaviour and Thermohydraulics Codes Testing for Supercritical Water-Cooled Reactors" with Research Project entitled "Heat Transfer to Supercritical Water and Distribution of Local Thermal and Hydraulic Parameters of Single-Phase Flow in Vertical 7-Rod Bundle Simulators".

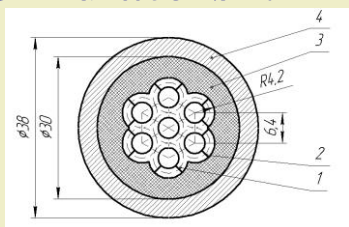


Fig. 2. Cross-section of the test section: 1 heated rod; 2 distancing rib; 3 shaped dielectric displacer; 4 pressure tube.

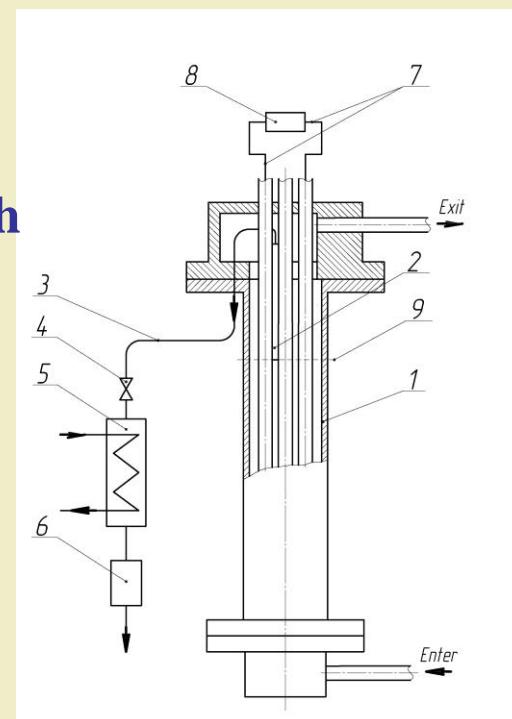


Fig. 3. To the method of isokinetic sampling: 1 test section; 2 sampler; 3 sampling line; 4 flowrate control valve; 5 calorimetric cooler; 6 flowmeter; 7 pressure gauge lines; 8 differential pressure gauge; 9 cross section of sampling.



DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

Separate research direction of the Department is the development of an automated control system for improvement of operational reliability and safety of the fuel elements. This system is based on noise characteristics analysis of operating parameters (neutron flux, dynamic pressure, coolant flow rate) at different heat-transfer modes. Methods of modern theory of artificial intelligence and the methods of neuroinformatics using artificial neuron networks were applied.



DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

For several decades one of the laboratories of the Department is developing the methods and the facilities of dust suppressing, foam decontaminators, mixtures of surface-active substances, agents that convert radionuclides into soluble state, complex formers, and emulsifiers to make feasible contribution in decontamination of the territory of Chernobyl' NPP.



DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

**Our student
participated several
times and won prize-
winning places in
international
conference on
nuclear security
ICONE**





DEPARTMENT OF NUCLEAR POWER PLANTS AND ENGINEERING THERMAL PHYSICS

- We are looking for extension of international cooperation of the Department with other countries and international organizations especially in the field of nuclear energy.**
- Experience exchange in area of education of students on nuclear energy.**
- Development of educational standards under the general guidance of IAEA at the international level for nuclear industry specialists training is of great importance.**



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**DEPARTMENT OF NUCLEAR POWER PLANTS
AND ENGINEERING THERMAL PHYSICS**

Thank You!