THE FIRST HIGHER TECHNICAL UNIVERSITY IN RUSSIA

MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION
Federal State Budgetary Educational Institution of Higher Education
"Saint-Petersburg Mining University"

IOM3 PD APPROVED

The Institute of Materials, Minerals and Mining

Approved by
Vice-Rector for Educational Activity
Prof. V.A. SHPENST

01/12/2016

Professional training program

«Chemical technology of natural energy resources and carbon materials»

Specialty: 18.04.01 «Chemical Technology»

Profile: «Chemical technology of natural energy resources and carbon materials»

Attendance: full-time

Course leader: Head of Department,
prof. N.K. Kondrasheva

Course developers: Associate Professor of Department
O.V.Zyryanova

Associate Professor of Department
S.N.Saltykova

SAINT PETERSBURG
2016

1. General provisions

1.1. The purpose of the program

The purpose of the program - to provide knowledge required to improve the skill level of workers and experts in chemical technology of fuel. The program is designed for professionals with higher and secondary vocational education.

1.2. Competencies to be formed

Core competencies to be built on the results of study are presented in Table

№	Categories of workers (type of professional activity)	Description of competence
1	Process engineers, operators of process plants	The ability and willingness to carry out process in accordance with the regulations
2		The ability to use technical means to measure the main parameters of the process, the properties of raw materials and products
3		Ability to justify the adoption of specific solutions in the development of technological processes; choose the technical means and technologies, taking into account the environmental consequences of their application

1.3. Requirements to the course achievement level

As a result, the development of training programs, students must:

know:

• physical and chemical laws of refining oil, gas and gas condensate feedstock;

• the basic equations of motion of fluids, basic theory of heat transfer, mass transfer basic theory;

• particular technology, physical and chemical mechanisms of the processes at different stages of the process;

• the latest achievements of science and technology in the preparation and processing of hydrocarbon raw materials;

be able to:

• determine the nature of the motion of gases and liquids, the main characteristics of heat and mass transfer;

• calculate the parameters and select equipment for a particular chemical-process; choose a rational energy and resource production of the specified product from the scheme, to evaluate the effectiveness of the production process;

• use the results of research and experimentation in the field of refining and petrochemicals;

• use the latest achievements of science and modern technology in the production and processing of hydrocarbons.

master:

• computing heat of reaction and the equilibrium constants of the chemical reactions at a given temperature, the rate constants of reactions;

• the method of choice of rational method of reducing the impact on the environment; methods of technological calculations of individual components and parts of chemical equipment;

• method of calculation of material and heat balances; design of the main equipment of the production with the use of modern technologies: computer applications, etc.

1.4. Course description

Type of work	**Hours**
Lectures	26
Laboratory (practical training)	13
Final assessment	1
Total hours of the course	**40**
Individual work	32
Total, hr	72

1.5. Curriculum

№	Name of module	Total hours	Including			Number of competencies to be formed
			lecture	Laboratory (practical training)	Individual work	
1	Introduction. Course overview	4	1		3	3
2	Module 1. Chemical technology of natural energy resources and carbon materials	16	6	4	6	1,2
3	Module 2. Hydro, heat transfer and mass transfer processes	24	12	4	8	1,2
4	Module 3. Modeling in chemical engineering and calculation of reactors	13	3	3	7	2,3
5	Module 4. Specialization (process technology of deep processing of oil and production of ecologically clean fuels)	10	4	2	4	1,2
	Final control	5		1	4	1,2,3
	Total	**72**	**26**	**14**	**32**	

1.6. Final assessment

Final assessment form - final test

1.7. Certificates

Trainees are given certificates after completing the short-term professional training program successfully (72 hours)

1.8. Academic staff involved in educational process

№	Full name	Education (university, year of	Position, academic degree, title.	List of basic scientific and

		graduation, specialty)	Experience in this area, years	educational publications
Course leader				
1.	Kondrasheva Natalia Konstantinovna	Ufa State Petroleum Technological University, 1976, Chemical technology of oil and gas	Head of the Department of Chemical Technology and processing of energy resources Doctor of Technical Sciences, Professor, 38 years	Author of over 150 scientific and educational works including 25 patents and 10 articles of Scopus
Staff				
2.	Dubovikov O.A.	Leningrad Mining Institute, 1972, non-ferrous metallurgy	Professor of the Department of Chemical Technology and processing of energy resources, Doctor of Technical Sciences, senior science master, 42 years	Author of over 100 scientific and educational works including 11 patents
3.	Saltykova S.N.	Leningrad Polytechnic Institute, 1981, non-ferrous metallurgy	Associate Professor of the Department of Chemical Technology and processing of energy resources, Candidate of Technical Sciences, Associate Professor, 32 years	Author of over 50 scientific and educational works including 5 patents
4.	Zyryanova O.V.	Leningrad Mining Institute, 1986, non-ferrous metallurgy	Associate Professor of the Department of Chemical Technology and processing of energy resources, Candidate of Technical Sciences, Associate Professor, 28 years	Author of over 50 scientific and educational works including 5 patents
5.	Rogacheva	Leningrad Institute	Associate Professor	Author of over

	N.P.	of Technology, 1976, plastics technology	of the Department of Chemical Technology and processing of energy resources, Candidate of Technical Sciences, Associate Professor, 45 years	45 scientific and educational works
6.	Velichkina N.G.	North-Western State Correspondence Technical University, 1971, Technology of basic organic and petrochemical synthesis	Associate Professor of the Department of Chemical Technology and processing of energy resources, Candidate of Technical Sciences, Associate Professor, 44 years	Author of over 50 scientific and educational works including 1 patents
7.	Kulinich O.V.	North-Western State Correspondence Technical University, 1977, Chemical technology of inorganic substances	Technology and processing of energy resources, Candidate of Technical Sciences, Associate Professor, 40 years	Author of over 45 scientific and educational works

2. CONTENTS
2.1. Course structure

Name of the professional module, theme	Contents of the educational material	The complexity (h)
Introduction. Course overview	The course program. The value of the fuel and energy complex in world economy	1
Module 1. Chemical technology of natural energy resources and carbon materials		
1.1. Preparation and primary refining	Characteristics of petroleum and petroleum products. Preparation and primary refining	2
1.2. High-temperature refinery processes	The catalytic cracking of vacuum gas oils. Thermal processing of crude oil. Production of bitumen	2
1.3. Hydroprocess	Hydroprocess	2
Module 2. Hydro, heat transfer and mass transfer processes		
2.1. Hydromechanical processes	Differential equations of motion of Euler. Bernoulli equation. Pumps. The main parameters of the pumps. Hydraulic resistance of pipelines. Determination of the optimal diameter of the pipeline.	4
2.2. Heat transfer processes	The basic equation of heat transfer. The thermal conductivity. Heat Thermal radiation. Convection and heat transfer.	4
2.3. Mass transfer processes	Fundamentals of mass transfer. Distillation	4
Module 3. Modeling in chemical engineering and calculation of reactors		
3.1. Chemical reactors	Mathematical models of reactors. Methods of optimization of chemical-technological processes. Understanding mathematical models Mathematical models of reactors. Methods of optimization of chemical-technological processes. Understanding mathematical models	3
Module 4. Specialization (process technology of deep processing of oil and production of ecologically clean fuels)		
4.1. Technology processes of deep oil refining and production of ecologically clean fuels	Production of high-polluting components of motor gasoline production processes of some special products from the gas The process of obtaining environmentally pure diesel fuel	4
Total (hrs)		26

2.2. Practical (laboratory) work and individual work under the guidance of a teacher

Practical (laboratory) work is the basis for the consolidation of practical skills. It is performed in specially equipped laboratories under the supervision of a teacher.

№	Name	Theme	Practical study, hour	Individual study, hour
1	Introduction			3
2	Calculation of the rectification column	1.1	4	6
3.	Removing pressure pump performance Determination of friction coefficient when moving gas stream by channels. Heat transfer by convection	2.1 2.2	4	8
4.	Calculation of a chemical reactor	3.1	3	7
	Analysis of the quality of motor trade fuels. Analysis of the structure of solid energy	4.1.	2	4
6.	Final test		1	4
	Total (hours)		14	32

3. Course facilities

The use of materials and devices of the laboratory of the department of chemical technology and natural energy, such as a scanning electron microscope Tescan, particle size analyzer AS200 control, spectrophotometer PE 5400UF, Micro Durometer DUH-211SShimadzu, Micro Durometer PMT - 3 M stereoscopic microscope MSP-2, microvizor pVizo-MET-221, a Brookfield viscometer RVDV-II +

4. Recommended reading

List of recommended textbooks, online resources for further reading.

a) main literature

1. Strategic priorities of Russian refineries / Edited by V.E. Somova. - M.: CNIITAneftechem, 2002, 292 p.
2. Development of oil and gas - the basis of development of the regions: Materials of scientific and practical conference 2006 года. - SPb:Himizdat, 2007, 200 p.
3. *Potechin V.M.*, Fundamentals of the theory of chemical process technology of organic substances and refining: The textbook for high schools / V.M. Potechin, V.V. Potechin. - Refining process, 2007, 944 p.
4. *Bannov P.G.* Refining process. - Refining process, 2009, 368 p.
5. *Bannov P.G.* The refining process. A teaching aid for training workers refining industry. Part 1. - M.: CNIITAneftechem, 2000, 224 p.

6. *Bannov P.G.* The refining process. A teaching aid for training workers refining industry. Part 2. - M.: CNIITAneftechem 2001, 415 p.
7. *Bannov P.G. Bannov P.G.* The refining process. A teaching aid for training workers refining industry. Part 3. - M.: CNIITAneftechem, 2003, 504 p.
8. *Ahmetov S.L.* The technology of deep processing of oil and gas. - M.: Gilem, 2002, 672 p.

b) additional literature

1. *Gaile A.A.* Aromatic hydrocarbons. Isolation, the use of market: Directory / A.A. Gaile, V.E.Somov, O.M. Varshavsky. SPb:Himizdat, 2000, 544 p.
2. *Rudin M.G.* Pocket Guide refiner. / M.G.Rudin, VE Somov, A.C. Fomin. M .: TsNIITEneftehim, 2004, 336 p.
3. *Sardanashvily A.G.* Examples and problems of technology for processing oil and gas. / Sardanashvily A.G., Lvova A.I. - 2nd ed., Trans. and add. - M .: Chemistry, 1980, 256 *p.*
4. *Kuznetsov A.A.* Calculations of processes and devices refining industry / A.A. Kuznetsov, S. Kagermanov, E.H. Sudakov.- 2nd ed., Trans. and add. L .: Chemistry, 1974, 344 p.
5. *Pavlov K.F.* Examples and problems at the rate of processes and devices of chemical technology / Pavlov K.F., Romankiv P.G., Noskov A.A. - 13 th ed. sr. M .: Alliance, 2006, 576 *p.*
6. *John. Perry.* Reference chemical engineer. Volume 1. Translated from English. Ed. Acad. Zhavoronkova N.M. and Corr. USSR Academy of Sciences Romankova P.G. M.: Chemistry, 1969, 640 p.
7. *D Perry.* Reference chemical engineer. Volume 2. Translated from English. Ed. Acad. Zhavoronkova N.M. and Corr. USSR Academy of Sciences Romankova P.G. M .: Chemistry, 1968, 504 p.
8. Software in chemistry and chemical technology. Mathcad 8 Standard. Methodical instructions. / V.A. Kholodnov, E.H., Ivanova, L.S. Kiryanov, V.M. Princelings. St. Petersburg: 2000, 52.
9. *B.J. Kuritsko The search for optimal solutions by means of EXCEL 7.0 in the examples.*
   SPb .: Publishing-BO"BHV- St. Petersburg ", 1997, 384 p. Ii).
10. *IvanovskyR.I.*Computertechnologiesinscienceandeducation. The practice of systems MathCAD 7.0 Pro, MathCAD 8.0 Pro and MathCAD 2000 Pro. workbook. SPb.: Publishing house SPbGTU, 2000.201 p.
11. Softwareamongleadingcomputercompanies. Overview. M .: NGOsMBT, 1997, 85 p.
12. *BeckerG.,* Introductiontothe electronic theory of organic reactions. M .: Mir, 1977, 93 p.
13. *Gafarov V.V.* Mathematical modeling of the basic processes of chemical industry products: Textbook for Universities / V.V. Gafarov, MB Glebov. MM: Vyssh.shk., 1991, 400 p.

c) database, information and referral and search engines http ://www. ehem.msu. su/cgi-bin/tkv. p! . http://www.twirpx.com. http://www.sciteclibrarv.ru/.