Ministry of Science and Higher Education of the Russian Federation

Federal State Autonomous Educational Institution of Higher Education
Perm National Research Polytechnic University

APPROVED BY
Pro-rector for Academic Affairs
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"9" 11 2021

ACADEMIC COURSE WORKING PROGRAM

Academic course: Chemistry, special chapters
(Name)

Form of education: Full-time
(Full-time /full-time - correspondence/correspondence)

Level of higher education: Bachelor's program
(Bachelor's program/specialist program/Master's program)

Workload in hours (in credits): 108 (3)
(Hours (CU))

Training program (degree): 15.03.06 Mechatronics and Robotics
(Code and denomination of degree)

Direction: Mechatronics and Robotics
(Title of curriculum)

Perm 2021

1. General Provisions

1.1. Goals and Objectives of the Course

The goal of the course is to learn the surface effects and disperse systems theory and their application in the industrial processes as well as formation of the students' skills of solving practical tasks in the field of applied colloid chemistry.

1.2. Prescribed Objects of the Course

Theory of colloid chemistry; Surface effects; Disperse systems

1.3. Starting Conditions

Unstipulated

2. Planned Results of the Course Training

Competence	Indicator's Index	Planned Results of the Course Training (to know, to know how, to master)	Indicator of Attaining Competence which the planned results of training are correlated with	Means of Assessment
GPC-1.	**IA-1**$_{pc-.1.}$	**To know** the methods of solving problems concerning professional activity by the application of natural scientific and engineering knowledge.	**Knows** the methods of solving problems concerning professional activity by the application of modelling, mathematical analysis, natural scientific and engineering knowledge	Test
GPC-1.	**IA-2**$_{pc-1.}$	**To be able to** solve problems related to professional activity by the application of natural scientific and engineering knowledge	**Is able to** solve problems related to professional activity by the application of modelling, mathematical analysis, natural scientific and engineering knowledge.	Test
GPC-1.	**IA-3**$_{pc-1.}$	**To master** the skills of solving problems related to professional activity by the application of natural scientific and engineering knowledge	**Masters** the skills of solving problems related to professional activity by the application of modelling, mathematical analysis, natural scientific and engineering knowledge	Report on practical lesson

3. Full time and forms of academic work

Form of academic work	Hours in all	Distribution in hours according to semesters
		Number of semester

		7
1. Holding classes (including results monitoring) in the form: 1.1.Contact classwork, including:	45	45
- lectures (L)	16	16
- laboratory work (LW)	18	18
- practice, seminars and/or other seminar-type work (PW)	27	27
- control of self-work (CSW)	2	2
- test		
1.2. Students' self-work (SSW)	63	63
2. Interim/midterm assessment		
Exam	-	-
Grading test		
Test (Credit)	9	9
Course Project (CP)		
Course Work (CW)		
Workload in hours	**108**	**108**

4. Course outline

Course sections with brief contents	Full time of classroom activity in hours according to the forms			Full time of extracurricular work in hours according to the forms
	L	LW	PW	SSW
Semester 7				
Thermodynamics of surface effects and processes The goal of the course. Thermodynamics of surface effects and processes. Method of Gibbs excess. Capillary forces. Fluid on the hard surface, wettability	4	0	4	10
Disperse systems.	10	0	20	47
Emulsions. Emulsions formation and stability. Emulsifiers and demulsifiers. Emulsions and processes of emulsification in industry. Dispersion of gas in fluid and fluid in gas. Foams. Foaming, defoaming agents and foam stabilizers. Aerosol spray. Dispersion of solid in liquid. Suspensions and sols. Applied rheology, thixotropy. Powders and porous media. Methods of estimating solids morphological parameters (specific surface and porosity). Powders in industry. Porous bodies in industry (absorbing and insulating materials).				
Solid-phase and heterogenetic systems	2	0	3	6
Special qualities of boundary phases in solid-phase heterogenetic systems (nanomaterials, composite materials)				
Total with regard to semester	**16**	**0**	**27**	**63**
Total with regard to the course	**16**	**0**	**27**	**63**

Topics of exemplary practical work

Sl.	Topic of practical work (seminars)

№	
1	Thermodynamics of surface effects.
2	Wetting. Adsorption on the liquid-liquid interface.
3	Adsorbents structure: specific surface, porosity.
4	Adsorption in solids: molecular absorption.
5	Absorption Isotherms
6	Absorption by solids: ion-exchanging absorption.
7	Formation and stability of emulsions.
8	Foams. Foaming.
9	Aerosols.
10	Suspensions and sols.
11	Powders.
12	Report on the prescribed theme.
13	Report on the prescribed theme.

5. Organizational and Pedagogical Conditions

5.1. Educational Technologies Used for Competences Formation

Holding lectures in the discipline is based on the active method of training in the process of which students are not passive but active participants of the lesson answering questions of the teacher. Teacher's questions are aimed at activating the process of learning material as well as at the development of logical thinking. The questions stimulating associative thinking and connecting new material with the previous one are formulated by the teacher in advance.

Practical lessons are held by realization of the method based on active training: problem areas are determined, groups are formed. The following aims are pursued in the process of practical education: use of definite disciplines knowledge and creative methods in solving problems and decision-making; students' skill-building of teamwork, interpersonal communication and development of leadership skills; consolidation of the basic theoretical knowledge.

Laboratory classes are based on an interactive learning method in which students communicate not only with the teacher but also with each other. At the same time, students ' activity in the learning process dominates. The teacher's place in interactive classes is reduced to orienting students ' activities to achievement of the goals of studies.

Interactive lectures, group discussions, role-playing games, training sessions, and analysis of situations and simulation models are used in academic studies

5.2. Students' Manual for the Course Study

Learning the course students are recommended to fulfill the following positions:

1. Learning of the discipline should be done systematically.
2. After learning one of the course unit with the help of the text-book or lecture notes it is recommended to reproduce the basic terms, definitions, notions of the unit from memory.
3. Special attention should be paid to the reports on practical studies, laboratory works and individual complex tasks for self-work.
4. The topics list for individual study is given by the teacher at the lectures. The teacher also provides students with literary sources (first of all, new ones in the periodical scientific literature) for a more detailed understanding of the issues presented at the lectures

6. List of Teaching Materials and Information Supply for Students' Self work in the Discipline

6.1. Paper-based courseware

Sl.№	Bibliographic entry (author, title, mode of publication, place, publishing house, year of publication, number of pages)	Number of copies in the library
1. Basic literature		
1	Schukin E.D. Colloid chemistry: textbook for universities/E.D.Schukin, A.V.Pertsov, E.A.Amekina. – Moscow: Higher school, 2004.	111
2. Additional literature		
2.1. Educational and scientific literature		
1	Gelfman M.I. Colloid chemistry /M.I.Gelfman, O.V.Kovalevich, V.P.Yustratov.-SPb: Lan, 2003	20
2	Myagchenkov V.A. Surface effects and disperse systems: manual for universities /V. A. Myagchenkov. – M.: KolosS, 2007	10
2.2. Standardized and Technical literature		
	Is not used	
3. Students' manual in mastering discipline		
1	Physical chemistry. Application of calculation procedures in chemical thermodynamics: manual for universities / O.I.Bachireva et al. – Perm: PSTU Publishing House, 2008.	288
4. Teaching and learning materials for students' individual work		
	Is not used	

6.2. Electronic Courseware

Kind of literature	Name of training tool	Reference to information resource	Accessibility of EBN (Internet/local net; authorized free assess)
Additional literature	Gelfman M.I. Colloid chemistry: textbook for universities / Gelfman M.I., Kovalevich O.V., Yustratov V.P. – SPb: Lan, 2020	http://elib.pstu.ru/vufind/Record/lanRU-LAN-BOOK-145851	the local network authorized access

6.3. License and Free Distributed Software used in the Course Educational Process

Type of Software	Software branding

OS	Windows 10 (Azure Dev Tools for Teaching)
Office Applications	Adobe Acrobat Reader DC, free software of PDF revision
Office Applications	Microsoft Office Professional 2007, license 42661567

6.4. Modern Professional Databases and Inquiry Systems Used in the Course Educational Process

Branding	Reference to information resource
Scientific electronic library database (eLIBRARY.RU)	https://elibrary.ru/
Scientific Library of Perm National Research Polytechnic University	https://lib.pstu/
Lan Electronic Library System	https://e.lanbook.com/
Electronic library system IPRbooks	https://www.iprbookshop.ru/
Information resources of the Network ConsultantPlus	https://www.consultant.ru/
Inquiry and communications system of normative technical documentation "Techexpert: norms, rules, standards and laws of Russia"	https://techexpert.ru

7. Logistics of the Course Educational Process

Type of classes	Name of the necessary basic equipment	Number of units
Lecture	Multimedia complex consisting of multimedia - ceiling mount Panasonic PT-W 430	1
Practice	Blackboard	1

8. Fund of the Course Evaluating Tools

Presented in separate document