СӘТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

Institute Mining and Metallurgical Institute

Department "Metallurgical processes, heat engineering and technology of special materials"

APPROVED by
Director of the MMI
Rysbekov K. B.
(Full name of Institute Director)
«01» 09 2022.

SYLLABUS

MET CODE 7622 "Special chapters of Extractive Metallurgy in English"

(code and name of the discipline)

EP "7M07204 – Metallurgy and mineral processing"

(cipher, name of the educational program)

5 credits 2/0/1/2

(the number of)

Semester: 3, Fall, 2022- 2023 academic year

(specify the semester number for the course, autumn/spring)

Almaty 2022

Information about instructor:

1.1 lecturer:

Chepushtanova Tatyana Aleksandrovna - associate professor, PhD, cand.tech.science, head of the department MPHE&TSM

(Full name of the teacher, position)

Learning format – online MTeams

office: **LECTURES online MTeams** Office-hours: Monday 10.00-10.50

(room, corpus)

Wednesday 12.10-14.05

Tel., 7346 e-mail: t.chepushtanova@satbayev.university

Link to lectures, online MTeams:
https://teams.microsoft.com/l/team/19%3a_2EnkyEi3fpmkt_rnNPBvCvzI2bYaks9P_sF-uMH7jc1%40thread.tacv2/conversations?groupId=0fa8a695-d7e1-49af-a6f0-e6be52007ba6&tenantId=49cc33db-453b-4ada-aaee-63c5dcd64f9c

1.2 Instuctor, conducting the practical/laboratory work

Mamyrbayeva Kulzira Kaldybekovna

(Full name of the instructor, position)

office: **Practice time online MTeams**

(room, corpus)

Wednesday 14.20-15.10

Tel., 7346 e-mail: k.mamyrbayeva@satbayev.university

Link to practice time, online MTeams:
https://teams.microsoft.com/l/team/19%3aUU7iUGFE7hJbe58SGg-yA6kJIxZxX-aaQK0tMob8yy01%40thread.tacv2/conversations?groupId=ddd6fbb2-2582-41f8-9e68-60df619d99d7&tenantId=49cc33db-453b-4ada-aaee-63c5dcd64f9c

2 The purpose and the objective of the course

The purpose: "Special chapters of extractive metallurgy in English" is to form students ' systematic knowledge about innovative technologies of extractive metallurgy, advanced domestic and foreign technologies, about advanced methods for extracting copper, processing uranium and sulfide gold-containing raw materials, with the study of the subject area of the specialty and professional terminology in English. The course examines the processing of critical raw materials for Kazakhstan and the global trends in the processing of metal-containing raw materials in general.

The objective:

- study of the main critical raw materials of Kazakhstan;

- study of the main critical raw materials by countries of the world;
- methodology of current technologies introduced into the production of Kazakhstan today in the field of processing of copper, uranium, REM, refractory metals;
- study of the process of liquid extraction of copper;
- study of the process of underground borehole leaching of uranium;
- study of REM processing technologies;
- study of technologies for processing refractory metals;
- learning terminology in English;
- study of technological schemes and hardware design of processes.

3 Course Description:

The course is intended for students of the educational program "7M07204 – Metallurgy and mineral processing".

The course provides theoretical patterns and practice of applying methods and technologies in extractive metallurgy. Technologies of processing of critically important raw materials for the industry of Kazakhstan are studied: copper raw materials, gold-arsenic, pyrite, uranium raw materials. The processes of extraction, sorption, sulfidizing and oxidative firing, modern extraction and sorption technologies, as well as innovative leaching techniques are considered.

As part of the course, the student will master the terminology and basics of extractive metallurgy in English.

The subject of the discipline is the main modern technologies for processing critical raw materials of existing enterprises today.

The course program is aimed at intensive study of hardware and technological schemes of copper extraction, processing of uranium, REM, sulfide gold-containing raw materials, with the study of professional terminology in English.

4. Learning outcomes

After completing the course, the student must demonstrate the ability to analyze extraction technologies in metallurgy, perform basic metallurgical calculations of material and thermal balances, model processes, and also know the terminological minimum on extractive metallurgy in English.

be able to:

- calculations of thermodynamic processes of firing and melting;
- determination of thermal engineering parameters of firing and melting processes;
- analysis of critical raw materials for processing.

skills:

- thermal analysis of metallurgical raw materials;
- thermodynamic and kinetic calculations;
- operation of 3D models of furnaces for the analysis of technologies for processing refractory metals;
- modeling of extraction processes of copper and uranium.

know:

- about the critically important raw materials for Kazakhstan and on a global scale;
- about technologies of processing of copper raw materials;
- about technologies of processing of uranium raw materials;
- about technologies of processing of rare earth metals;
- about technologies of refractory metals;

Formed competencies:

a) Universal (CC): the

ability to critically analyze and evaluate modern technologies for processing critical metals;

and carry out comprehensive research on the processing of stubborn raw materials;

the ability to plan and solve the tasks of their own professional and personal development in the field of processing critical raw materials;

b) General professional (MIC):

knowledge of the methodology of theoretical and experimental research in the field of processing of critical raw materials for Kazakhstan;

knowledge of methods of metallurgical calculations using modern calculation programs.

5 Calendar and thematic plan

A week	Topic of the lecture session	The topic of practical classes	Link to the literature	Task	Deadline for delivery
1	Introduction. Principles of Extractive Metallurgy	Introduction to the Extractive Metallurgy Workshop	[1] c. 1-75, LMS lecture 1.	P1	-
2	Hydrometallurgical innovation technologies. Resources	Construction of phase equilibrium diagrams of various systems, Purbe diagrams (analysis and calculations) according to the HSC Outocumpu program	[2 доп] c. 1-80, [2] c. 1-70, LMS лекция 2.	P2	Passing P1
3	Modern leaching methods, examples and analysis of technologies	Construction of phase equilibrium diagrams of various systems, Purbe diagrams (analysis and calculations) according to the HSC Outocumpu program	[1] c. 1-63, [2 доп] c. 1-70, LMS lecture 3.	P2	Passing P2
4	Liquid extraction of copper	Modeling of the liquid extraction process according to the SOLVAY EXTRACTION program	[1] c. 40-50, [2] c. 20-31, LMS lecture 4.	P3 Extradition IWMS-1.	Passing P2

5	Problems of hail formation during liquid copper extraction	Modeling of the liquid extraction process according to the SOLVAY EXTRACTION program	[1]c. 155-158, [3] c. 72-128, LMS lecture 5.	P3	Passing P3
6	Leaching of valuable components from secondary raw materials	Calculation of material flows of the leaching process	[1]c. 202-233, [2] c. 72-128 LMS lecture 6.	Issuance of IWMST -1. P4	Passing P3 Passing IWS -1.
7	Extraction of REM from catalysts and electronic scrap	Vacuum melting of refractory materials	[1]c. 160-199, [3] c. 79-100, LMS lecture 7	P5	Passing P4, П7. Passing IWMST-1.
8	1st intermediate (Midterm) certification		Lectures 1-8	LMS Lectures 1- 7.	Passing CW 1
9	Analysis of uranium production	Calculation of the extraction process	[1]c. 233-263, [2] c. 103-110, LMS lecture 9	P6	Passing P5
10	Uranium leaching	Calculation of the sorption process	[3 доп]c. 214-233, LMS lecture 10, [2] c.118-123	P7. Issuance of IWMS-2.	Passing P6
11	Extraction and sorption in uranium technology	Calculations of extraction and sorption indicators of extraction of non-ferrous metals	[3 доп] c. 265-338, LMS lecture 11.	P8. Issuance of IWMS - 2.	Passing P7
12	Processing of sulfide, pyrite - arsenic-containing raw materials	Thermal analysis of sulfide raw materials	[1] 265-314 LMS lecture 12.	P9	Passing P8. Passing IWMS-2.
13	Technologies for processing gold-arsenic raw materials	Analysis of thermograms using the Proteus program, radiographs, diffractograms and the results of electron microscopic analysis of JEOL firing products	[2]c. 350-400 LMS lecture 13.	P10.	Passing P9
14	Autoclave technologies for processing gold-containing raw materials	Analysis of thermograms using the Proteus program, radiographs, diffractograms and the results of electron	[1]c.2 vol. 280-380, LMS lecture 14.	P10	Passing P10. Passing IWMST-2.

		microscopic analysis of JEOL firing products			
15	2nd final (Endterm) certification		LMS Lectures 8-14.	CW 2	Passing P10
	Exam		Lectures 1-14	Tickets	According to the schedule

6 Literature

Required	Supplementary
[1] R.E. Smallman, R.J. Bishop. Modern Physical Metallurgy and Materials Engineering. Elsevier, UK, 2020, P. 448.	[1] Theodore L., Bergman A., Lavine S. Fundamentals of heat and mass transfer. 7 Edition. USA. John Wiley and Sons. 2017. P.728.
[2] F. Habashi. Handbook of extractive metallurgy. 6 Edition. Wiley-VCH, Volume 1-4. Germany, 2021. P. 2379.	[2] Merle C. Potten, Craig W. Somerton. Theory and problems of thermodynamics for engineers. McGPAW-Hill. USA, 2020. P. 380.
[3] M. Schlesinger, K.Sole, W. Davenport, G. Alvear. Extractive metallurgy of copper. 6thEdition, 2021, P. 569.	[3] T. Havlik. Hydrometallurgy. Principles and application. England, Cambridge. 2008. P. 551. [4] https://www.pdfdrive.com/search?q

7 Competence framework

Learning Descriptors	Competencies				
	Natural science and theoretical and ideological	Socio-personal and civil	General engineering professional	Cross-cultural and communicative	Specially-professional
Knowledge and understanding	x				x
Application of knowledge and understanding	x		x		
Expression of judgments and analysis of actions		x			
Communication and creative abilities		x	x		
Self-learning and digital skills	x		x		

8 Schedule of submission of mandatory assignments

№	Types of control	Max score of the week	Weeks														Total max points
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	Activeness in lecture discussions	0,5		*	*	*	*	*	*		*	*	*	*	*	*		6
2	Master Independent Study with teacher MISWT	3,0							*							*		6
3	Performing practical exercises	2,6	*	*		*		*	*		*	*	*	*	*			26
4	1st Intermediate Certification (Midterm)	6,0								*								6
5	Master Independent Study (MIS)	4,0						*						*				8
6	2nd final certification (End	8,0															*	8

	term)																
7	Final exam	40															40
8	Total in total																100

9 Evaluation rating and possible final versions of assessments according to criteria

Letter grade	GPA	scores	Criteria
A	4	95-100	Shows the highest standards of knowledge, exceeding the volume of the course taught
A-	3,67	90-94	Meets the highest standards of knowledge
B+	3,33	85-89	Very good and meets high standards of knowledge
B	3	80-84	Good and meets most high standards of knowledge
B-	2,67	75-79	More than sufficient knowledge approaching high standards
C+	2,33	70-74	Sufficient knowledge that meets the general standards
C	2	65-69	Satisfies and conforms to most common knowledge standards
C-	1,67	60-64	Satisfies, but according to some knowledge does not meet the standards
D+	1,33	55-59	Minimally satisfying, but does not meet the standards for a large range of knowledge
D	1	50-54	Minimally satisfactory passing score with questionable compliance with standards
FX	0,5	25-49	Temporary assessment: Unsatisfactory low indicators, retake of the exam is required
F	0	0-49	Didn't try to master the discipline. It is also exposed when a student tries to get a grade on the exam by cheating
I	0	0	Temporary assessment: A student who completed most of the course successfully, did not complete the final control measures due to valid circumstances
W	0	0	The student voluntarily withdrew from the discipline and did not master it until the 6th academic week
AW	0	0	The student was removed from the discipline by the teacher for systematic violations of academic order and rules

10 Evaluation criteria

Each work except tests is evaluated according to 4 criteria:

– precision and accuracy (A) – 30% (how accurately and neatly the work is calculated);

– inventiveness and creativity (T) – 30% (how and in what way the work is presented);

– completeness and maturity (H) – 40% (how profoundly, logically and structurally the work is solved);

– originality (O) – a special coefficient of 1.0, 0.5 or 0 is used.

Criteria	Great (0.9-1.0)	Well (0.7-0.9)	Satisfactory (0.4-0.7)	unsatisfactory (0-0.4)
Accuracy of calculation	The schemes are made clearly and accurately; all calculations are carried out mathematically correctly	There are minor inaccuracies in the calculations (minus 0.1 – for each inaccuracy)	The diagrams are made carelessly, there are significant inaccuracies in the calculations (minus 0.1 – for each inaccuracy in the calculations and execution of drawings)	The diagrams were made carelessly, the calculations were carried out incorrectly (minus 0.1 – for each inaccuracy in the calculations and execution of drawings)
Creativity and creativity	The use of non-standard solutions; demonstration of	A standard approach within the framework of methodological	A standard approach within the framework of methodological guidelines without	Deviation from the minimum standard of presentation

	knowledge and their application.	guidelines with a clear scenario plan of presentation	demonstrating a clear outline of the presentation	
Completeness of the calculation	The calculations were carried out mathematically accurately in full using non-standard solutions; all drawings and diagrams are made clearly and accurately	The tasks are completed completely with minor errors, all drawings and diagrams are made clearly and accurately (minus 0.1 – for each inaccuracy)	The calculations are presented either with significant errors; or they are not fully completed; there are inaccuracies in the execution of drawings and diagrams.	There are no correct answers to the questions; the solution of the problems is either absent or irrelevant to the content of the problem.
Originality	1.0 - the work is completely original, authentic and made by the applicant's own efforts		0.5 - the work is written off from a colleague (the coefficient is set to both)	0-the work and its significant fragments are borrowed from other sources without original references

The overall score will be calculated due to the formula*:*

Score = (A + T + 3) ×O

Maximum assessment of knowledge by type of tasks

Tests and activeness	12 lectures with 0.5 points=6
Master Independent Study with teacher MISWT	2 MISWT for 3 points=6
Practical classes and bonus	10 papers with 2.6 points=26
1st attestation (Midterm)	CW-1: 6 points =6
Master Independent Study (MIS)	2 MIS of 4 points=8
2nd final attestation (Endterm)	CW-2: 8 points =8
Final exam	40
Total	**100**

11 Late submission policy

The student must come prepared for lectures and practical (laboratory) classes. Timely protection and full performance of all types of work (practical and independent) is required. The student should not be late and miss classes, be punctual and mandatory. It is planned to reduce the maximum score by 10% for untimely work. If you are forced to skip the intermediate certification for good reasons, you should warn the teacher in advance before it, so that you can pass the boundary control in advance. Skipping an exam for a disrespectful reason deprives you of the right to take it. If you miss the exam for a good reason, a special permit is issued and the date, time and place of the exam are assigned.

12 Academic Conduct and Ethics Policy

Be tolerant, respect the opinions of others. Formulate objections in the correct form. Plagiarism and other forms of dishonest work are unacceptable. Prompting and cheating during exams, passing the exam for another student are unacceptable. A student caught falsifying any course information will receive a final "F" grade.

Activeness in lectures and practical classes is mandatory and is one of the components of your final score / assessment. Many theoretical questions supporting the lecture material will be presented only at lectures. Therefore, skipping a class can affect your academic performance and final grade. However, attending classes

in itself does not mean an increase in points. Your constant active participation in the classes is necessary. A mandatory requirement of the course is to prepare for each lesson. It is necessary to review the specified sections of the textbook and additional material not only in preparation for practical classes, but also before attending the corresponding lecture. Such training will facilitate your perception of new material and will contribute to your active acquisition of knowledge within the walls of the university.

Support: For advice on implementing the independent work, their submission and defending, as well as for additional information on the material covered and all other questions arising on the course being read, contact the teacher during their office hours or via electronic means of communication during working hours.

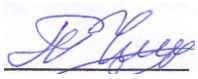
During the process of learning:

Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson. In case of absence, the student is obliged to notify the teacher within a day and explain the plan for self-study of the study material:

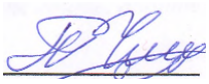
- mandatory reading of the presented materials before the lesson;
- submission of tasks on time;
- 20% non-participation in the audience (for a valid reason with the supporting documents) - rating "F (Fail)";
- plagiarism and cheating during the execution of the task are not allowed;
- mandatory use of electronic gadgets in the classroom that is welcome, but it is unacceptable to use them in the exam.

Within the framework of training in the discipline, any corruption manifestations in any form are unacceptable. The organizer of such actions (teacher, students or third parties on their behalf) are fully responsible for violating the RK laws.

Considered at the meeting of the MPHE&TSM Department
Minutes № 1, 16.08.2022

Head of the department MPHE&TSM  **T. A. Chepushtanova**

Syllabus designer:
Associate Professor, Candidate

of Technical Sciences, Doctor PhD  **T. A. Chepushtanova**