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| Module designation | GEO 7432 "Lithology of natural oil and gas reservoirs" |
| Semester(s) in which this module is taught | 2nd semester |
| The person responsible  for the module | Ensepbayev Talgat Ablaevich  – Professor |
| Language | Russian |
| Attitude to the  curriculum | Profile (P) |
| Teaching methods | lecture, presentations, discussions, practice |
| Workload (incl. contact hours, hours of independent work) | ((Estimated) Total workload: 5 сr  Contact hours (please indicate whether there will be a lecture, exercise, laboratory session, etc.): 45h  Private training, including exam preparation, specified in hours 24 :  15h |
| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the module | Availability of a computer and computer equipment.  Availability of an Internet channel with a speed of at least 0.5 Mbit/sec.  A personal account with a photo of the person on the avatar and corporate email on the Microsoft 365 platform.  Attendance of classes is mandatory according to the schedule. |
| Module objectives/expected learning outcomes | The purpose of teaching the discipline GEO 7432 "Lithology of natural oil and gas reservoirs"  is to provide undergraduates with theoretical ideas about the classification of sedimentary rocks, types of lithogenesis, methods of lithological studies of rocks, the main stages of formation and transformation of sedimentary rocks, definitions and descriptions of the composition, structure and texture of rocks, generalize analytical data.  -know the types of sedimentary rocks, the stages of formation and transformation of sedimentary rocks, the most common natural reservoirs,  causes of deposition of matter, sedimentation textures, sedimentary  rock structures. |
|  | * know the concept of facies   -master the methods of geological and lithological studies   * graphically display oil and/or gas deposits and their lithological content using maps and profile sections of wells. |

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| Content | * The subject of lithology is the tasks of science, the practical significance of the doctrine of sedimentary rocks. The material composition of the Earth's crust. Similarities and differences in the chemical composition of sedimentary and igneous rocks. * The structure of sedimentary rocks.   Classification of sedimentary rocks. Textures of sedimentary rocks. Sedimentary rock structures. Pyroclastic rocks. Classification and geological distribution of pyroclastic rocks. |
|  | * Stages of formation and transformation of sedimentary rocks. Transfer of sedimentary material. * Autigenic and allotigenic components of sedimentary rocks. Mineral composition.   Rock-forming minerals.   * Actually detrital rocks. Genetic classification and geological distribution of clastic rocks. Granulometric analysis. Terrigenous reservoirs of oil and gas. * Clay rocks. Mineral composition. Conditions of education. Geological distribution. Diagnostics of allotigenic and autigenic components. * Sedimentary rocks of chemical origin (chemobiogenic). Principles of classification, structures and textures of rocks, their mineral composition, conditions of formation and practical significance. * Sedimentary rocks of organogenic origin. Principles of classification, structures and textures of rocks, their mineral composition, conditions of formation and practical significance. * Carbonate rocks. Primary and secondary porosity in carbonate reservoirs of oil and gas. Evaporites. * Conditions for the formation of sedimentary rocks. Stage of hypergenesis. Types of weathering. Weathering products.. * Sedimentogenesis. Causes of precipitation of the substance. Oil and gas sedimentation * Sedimentation textures. Underwater slope basin, shelf margin and shallow shelf. Tidal plains. Evaporites * Diagenesis. The processes occurring during the diagnosis. Formation of stable mineral modifications. The role of tectonics in the process of diagenesis. Influence * Metagenesis. Distinctive features of breeds that have passed the stage of metagenesis. General remarks on the conditions of formation of sedimentary rocks. The frequency of sedimentation. Igneous and   metamorphic rocks as possible reservoirs of oil and gas. |
| Examination forms | Open questions, tests |

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| Requirements for training and exams | Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson. A  master's student should come prepared for lectures and practical classes. Timely protection and full performance of all types of work  (practical and independent) is required. |
| List of literature | 1. Kuznetsov Vitaly Germanovich, Lithology. Fundamentals of general (theoretical) lithology Textbook for universities. - M.: Scientific world, 2011. - 360 p. 2. Proshlyakov B.K., Kuznetsov V.G. Lithology: Textbook for universities M.: Nedra, 1991. – 444 p. 3. Proshlyakov B.K., Kuznetsov V.G. Lithology and lithological- facies analysis. – M., Nedra, 1981. – 284 p. 4. Pettijohn F. J. Sedimentary rocks. M., Mir, 1981. 751 p. 5. [Somasankara Rao Koppisetti](https://www.amazon.ca/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Somasankara+Rao+Koppisetti&text=Somasankara+Rao+Koppisetti&sort=relevancerank&search-alias=books-ca). Understanding of Depositional Environment of Sedimentary Basins: Sedimentary Facies and Environments. LAP LAMBERT Academic Publishing, 2017 6. 5. Alekseev V.P. Lithology: A textbook. – Yekaterinburg: UGGA Publishing House, 2001. – 249 p. 7. Yezhova A.V. Lithology. Educational   stipend. – Tomsk, TPU, 2005. -353 p. 21. Karogodin Yu.N. Introduction to petroleum litmology.   1. Naumov V.A. Optical determination of sedimentary rock   components. M., Nedra, 1981. 202 p. |

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| Module designation | Geo7462 Theoretical and methodological regularities of the  allocation of resources and reserves of hydrocarbon raw materials on the shelf and water area |
| Semester(s) in which this module is taught | 1 semester |
| The person responsible  for the module | Nigmatova Saida Arapovna – Associate Professor |
| Language | russian |
| Attitude to the  curriculum | Profile (P) |
| Teaching methods | lecture, presentations, discussions, practice |
| Workload (incl. contact hours, hours of independent work) | ((Estimated) Total workload: 3 сr  Contact hours (please indicate whether there will be a lecture, exercise, laboratory session, etc.): 45h  Private training, including exam preparation, specified in hours 24 : 15h |
| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the module | * Availability of a computer and computer equipment. * Availability of an Internet channel with a speed of at least 0.5 Mbit/sec. * Personal account with a photo of the person on the avatar and corporate mail on the Microsoft 365 platform. * Attendance of classes is mandatory according to the schedule. |

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| Module objectives/expected learning outcomes | The purpose of teaching the discipline Geo7462 "Theoretical and methodological regularities of the placement of resources and reserves of hydrocarbon raw materials on the shelf and in the water area" is to get undergraduates theoretical ideas about the patterns of formation and accumulation of hydrocarbons in the waters of the seas and oceans of the Earth; the principles of forecasting accumulations of hydrocarbons and the stages of geological exploration in the waters.   * solve geodynamic problems; * analyze the geodynamic evolution of certain sections of the lithosphere; * to link geodynamic processes with the formation and forecasting of hydrocarbon deposits. |
| Content | General information about the formation of organic substances and oil in the water area and shelf. Paleogeography. The relationship of oil accumulation processes with the climate. The composition of the organic world of the water areas and the shelf. Formation of biogenic build-ups. Basic knowledge and skills in the field of geotectonics and geodynamics of oil and gas areas. The main provisions of the theory of plate Tectonics. Evolution of tectonic science from fixism to plate tectonics. Continental, marine and transitional facies. Schematic diagram of the formation. Offshore oil and gas fields. Gas hydrates of the seas and oceans. Isolation and study of oil and gas complexes (terrigenous, carbonate) offshore areas. Gas hydrates. Genesis, conditions of accumulation and preservation. Lithological-facies and filtration-capacitance criteria of shelf oil and gas potential. Oil and gas basins of water areas. Classification and features about different types. Fluid-dynamic features of oil and gas formation in the water areas of sedimentary basins. The basic principles of assessing the prospects of oil and gas potential of water areas. Prediction of HC accumulations in water areas. The stage of geological exploration on the shelf. Features of prospecting and exploration work for the development of hydrocarbon deposits on the shelf. Prospects for hydrocarbon production in the northern and southern parts of the Caspian Sea  shelf. Patterns of distribution of oil and gas basins and placement of hydrocarbon deposits in water areas. |
| Examination forms | Open questions, tests |
| Requirements for training and exams | Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson. A master's student should come prepared for lectures and practical  classes. Timely protection and full performance of all types of work (practical and independent) is required. |

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| List of literature | 1. 1 Jafarov I.S., Kerimov V.Yu., Shilov G.Ya. Shelf, its study for prospecting and exploration of oil and gas accumulations. Nedra, St. Petersburg, 2005, 384 p. 2. 2 Maksimov E.M. Marine geology. - Tyumen State University, Tyumen.- 2014 - 370 pages . 3. 3 Zapivalov N. P. Oil and gas potential of the water areas of the world: A textbook / ... Novosibirsk, 2009. - 260 p. 4. 4 About the state program of the Kazakhstan sector of the Caspian Sea. Decree of the President of the Republic of Kazakhstan. 22.112010.No.1105. 5. 5 Carbonate rocks – Moscow: Mir, 1970, vol.1. 395 p., 1971, vol.2. – 267 p. 6. 6 Kenneth J. Marine geology. In 2 volumes. –Moscow: Mir, 1987, vol.1 – 365 p., vol.2 – 383 p. 7. 7 Lisitsin A.P. Processes of ocean sedimentation. – M.: Nauka, 1978. – 392 p. 8. 8 Reinek G.E., Singh I.B. Conditions of terrigenous sedimentation. – M.: Nedra, 1981. -439 p. 9. 9 Romanovsky S.P. Dynamic modes of sedimentation. – L.: Nedra, 1985. 201 p. 10. 10 Wilson J.L. Carbonate facies in geological history.   Moscow: Nedra, 1980.- 463 p.   1. 11 Frolov V.T. Genetic typification of marine sediments. – M.: Nedra, 1984. -242 p. 2. 12 Cyclic and event sedimentation. –Moscow: Mir, 1985. – 156 p. 3. 11. Kazansky Yu.P., Betekhtina O.V., Van A.V. et al..   Sedimentary rocks (composition, textures, types of sections)  // Novosibirsk: Nauka, 1990. – 267 p. |

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| Module designation | GEO7442 Regional and local modeling of sedimentary basin evolution |
| Semester(s) in which this module is taught | 3rd semester |
| The person responsible for the module | Tanirbergenov Amanzhol Gizzatovich, Assistant Professor |
| Language | russian |
| Attitude to the  curriculum | Profile (P) |
| Teaching methods | Explanatory and illustrative, reproductive, discussions, methods of stimulation and motivation of educational and cognitive activity |
| Workload (incl. contact hours, hours of independent work) | ((Estimated) Total workload: 3 cr  Contact hours (please indicate whether there will be a lecture, exercise, laboratory session, etc.): 45h  Private training, including exam preparation, specified in hours 24 : 15h |

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| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the module | Availability of a computer and computer equipment. Availability of an Internet channel with a speed of at least 0.5 Mbps. Personal account with a photo of a person on the avatar and corporate email on the Microsoft 365 platform. Attendance is required in accordance with the schedule. |
| Module objectives/expected learning outcomes | As a result of mastering the discipline, the student should know: - scientific and methodological foundations and algorithm of structural and genetic analysis of sedimentary formations; - the main types of sedimentary basins; - a typical formation series of sedimentary basins; - large sedimentary basins of Kazakhstan and the world; - the role of the neotectonic factor in the formation of mineral deposits, including hydrocarbons.  Be able to: - identify lateral changes in their structure and reconstruct the conditions of their formation to predict the structure of natural reservoirs during the search, exploration and operation of various fields; - reconstruct the history of the development of the paleobasein; -assess the oil and gas content of various sedimentary basins.  Mastering: - methods of studying sedimentary basins, about the characteristics, types of sedimentary basins and their connections with oil and gas, about the patterns of the location of large accumulations of hydrocarbons in the system of sedimentary basins. |
| Content | Introduction. The main categories of sedimentary basins. The actual composition of sedimentary basins. Sedimentary complexes of basins of the mobile belt. Pools of internal parts of movable belts.  Geothermy of sedimentary rock basins. Application of geothermal research in petroleum geology. Reconstruction of the history of immersion of sedimentary basins. The thermal regime of swimming pools and the conditions of maturation of organic substances at different stages of development. |
| Examination forms | Open questions, tests |
| Requirements for training and exams | Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson.  The master's student must come prepared for lectures and practical classes. Timely protection and full performance of all types of work (practical and independent) is required. |

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| List of literature | 1. Sedimentary basins. M., 2004, coll. auth. edited by Yu.G.Leonov and Yu.A.Volozha. 2. Lobkovsky L. I., Nikishin A.M., Khain V. E. Modern problems of geotectonics and geodynamics. Moscow: Scientific World, 2004. 610 p. 3. Sedimentary basins: methods of study, structure and evolution/ Edited by Yu. G. Leonov and Yu. A. Volozh. Moscow: Scientific World, 2004. 525 p.   4 Sedimentation and facies environments/ Edited by H. Reading. Moscow: Mir, 1990. Vol.1. 350 p. Vol.2. 380 p. |

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| Module designation | GEO7012 - Geostatistics in field and field geological research |
| Semester(s) in which this module is taught | 3rd semester |
| The person responsible for the module | Tanirbergenov Amanzhol Gizzatovich, Assistant Professor |
| Language | russian |
| Attitude to the  curriculum | Profile (P) |
| Teaching methods | Explanatory and illustrative, reproductive, discussions, methods of stimulation and motivation of educational and cognitive activity |
| Workload (incl. contact hours, hours of independent work) | ((Estimated) Total workload: 3 cr  Contact hours (please indicate whether there will be a lecture, exercise, laboratory session, etc.): 45h  Private training, including exam preparation, specified in hours 24 : 15h |
| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the module | Availability of a computer and computer equipment. Availability of an Internet channel with a speed of at least 0.5 Mbps. Personal account with a photo of a person on the avatar and corporate email on the Microsoft 365 platform. Attendance is required in accordance with the schedule. |

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| Module objectives/expected learning outcomes | The objectives of mastering the discipline "Geostatistics in field and field-geological research" are the formation of professional competencies of undergraduates related to the use of mathematical and statistical methods of information processing using a PC in their professional field, namely: to be able to master mathematical methods of processing raw data on hydrocarbon deposits, to instill in them the skills of this processing and the use of computer tools; to master the complexes of mathematical methods necessary for geological and commercial generalization of the results of research and exploration and development of oil and gas fields;  To teach undergraduates to apply the acquired skills of mathematical data processing and 3-dimensional modeling of hydrocarbon deposits when calculating reserves and geological justification of development. |
| Content | Introduction. Random variables and random phenomena in oil and gas field geology. Sampling and general population, probabilistic model. The study of the features of the distribution of parameters of heterogeneous productive layers using mathematical methods. The main characteristics of distributions. Mathematical expectation.  Variance. Distribution functions in oil and gas field geology. The concept of distribution functions. Examples of discrete theoretical distributions. Continuous distributions. Probability levels. Parameter estimates and their quality. Confidence probability and confidence interval.  Entropy in oil and gas field geology. Comparison of the distribution series of the values of the parameters of productive formations. |
| Examination forms | Open questions, tests |
| Requirements for training and exams | Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson.  The master's student must come prepared for lectures and practical classes. Timely protection and full performance of all types of work (practical and independent) is required. |
| List of literature | 1. Gutman I.S. Application of mathematical methods and computers in oil and gas field geology: Textbook. – M.: MINHiGP, 1976. 2. Gutman I.S. Methods of calculating oil and gas reserves: Textbook for universities. M.: Nedra, 1985. 3. Dubroul O. The use of geostatistics for inclusion in the geological model of seismic data. SEG, EAGE, 2002. 4. Bondarenko V.N. Statistical solutions of some problems of geology. Moscow: Nedra, 1970. |

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| Module designation | GEO992 Petroleum Hydrogeology |
| Semester(s) in which this module is taught | 3rd semester |

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| The person  responsible for the module | Tanirbergenov Amanzhol Gizzatovich, Assistant Professor |
| Language | russian |
| Attitude to the  curriculum | Profile (P) |
| Teaching methods | Explanatory and illustrative, reproductive, discussions, methods of stimulation and motivation of educational and cognitive activity |
| Workload (incl. contact hours, hours of independent work) | ((Estimated) Total workload: 3 cr  Contact hours (please indicate whether there will be a lecture, exercise, laboratory session, etc.): 45h  Private training, including exam preparation, specified in hours 24 : 15h |
| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the module | Availability of a computer and computer equipment. Availability of an Internet channel with a speed of at least 0.5 Mbps. Personal account with a photo of a person on the avatar and corporate email on the Microsoft 365 platform. Attendance is required in accordance with the schedule. |
| Module objectives/expected learning outcomes | The purpose of the course “ Petroleum hydrogeology” is to gain knowledge about the hydrogeology of oil and gas basins, oil and gas fields, the peculiarities of the formation of underground fluids of deep aquifers containing hydrocarbons, the role of groundwater in the formation, preservation and destruction of hydrocarbon deposits, as well as the practical importance of groundwater in the development of oil and gas fields.  A master's student should be able to:   * apply modern methods of oil and gas, oil and gas prospecting and oil and gas field hydrogeology. * give a mathematical statement of the problem To know: * basic concepts of oil and gas hydrogeology, the role of groundwater in the formation, migration, accumulation, preservation and destruction of hydrocarbon deposits, features of hydrogeodynamics and hydrogeochemistry of groundwater of oil and gas fields, the main tasks and methods used in oil and gas exploration hydrogeology and in the development of hydrocarbon deposits.   possess: basic skills in solving geological problems by constructing and calculating the necessary geological exploration for oil and gas and the development of hydrocarbon deposits.  After completing the course, the master's student must demonstrate the ability to solve geological problems by constructing and calculating the necessary geological exploration for oil and gas and the development of hydrocarbon deposits |

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| Content | Content - getting up-to-date ideas about the formation of underground waters of deep horizons and, in particular, about the role of groundwater in the formation, preservation and destruction of hydrocarbon deposits, get acquainted with the principles and methods of prospecting hydrogeological works for oil and gas; gain knowledge about multiphase filtration, features of the movement of geofluids of variable density and viscosity; get acquainted with the basics of paleohydrogeology and paleohydrogeological methods used in the search for oil and gas deposits; to gain knowledge about the features of the chemical composition, water-dissolved gases, water- dissolved organic matter, isotopic composition of underground waters of oil and gas fields and their practical significance; to get acquainted with the main hydrogeological criteria for assessing the prospects of oil and gas potential and to master existing hydrogeological oil and gas prospecting methods, to acquire knowledge about the main types of hydrogeological studies conducted at oil and gas wells at exploration and exploitation of deposits. |
| Examination forms | Open questions, tests |
| Requirements for training and exams | Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson.  The master's student must come prepared for lectures and practical classes. Timely protection and full performance of all types of work (practical and independent) is required. |
| List of literature | Matusevich V.M. Oil and gas hydrogeology, part 1.Tyumen, 2010.  Kartsev,A.A. Vagin S.B. Matusevich V.M. Hydrogeology of oil and gas basins M., Nedra, 2001  Dunin V.I., Korzun A.V. Hydrogeodynamics of oil and gas basins., M, Scientific World. 2005  Kanalin V.G., Vagin S.B. Oil and gas field geology and hydrogeology. M. Nedra 1997. |

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| Module designation | Analysis of sedimentary basins |
| Semester(s) in which this module is taught | Spring |
| The person  responsible for the module | Uzbekgaliev Rizakhan Khalilovich - candidate of geological and mineralogical sciences, senior lecturer. |
| Language | russian |
| Attitude to the  curriculum | Profile (P) |

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| Teaching methods | 1. Reception "Bloom's cube". The student, answering the questions: "name", "explain", "suggest", "invent", "share" reproduces what he knows. Then moves on to cause-and-effect connections, analyzes, and evaluates. As a result, everything is aimed at activation of thinking activity;  2.The "Insight" technique. After announcing the topic (problem), the instructor allows students to recall what they know or have heard about it. Then they exchange information with each other in pairs, then in groups and record these data. And only after that is given the ready text of the topic. After analyzing the text, students make a table (mentally) "knew", "found out", and "want to know";  3. Brain storm;  And their combinations. |
| Workload (incl. contact hours, hours of independent work) | ((Estimated) Total workload: 3 cr  Contact hours (please indicate whether there will be a lecture, exercise, laboratory session, etc.): 45h  Private training, including exam preparation, specified in hours 24 : 15h |

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| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the module | To successfully master the course "Analysis of sedimentary basins", the student must be a trained specialist in the structure, composition and classification of sedimentary rocks, sediment accumulation processes, the basics of stratigraphy, structural geology, petroleum geology, principles of regional geological zoning. The discipline is closely related to geodynamics in the context of the modern concept of geology. |
| Module objectives/expecte d learning outcomes | -To have an idea of:  classifications of sedimentary basins in historical retrospect; the relationship of the structure of sedimentary basins, paleogeographic and paleogeological conditions of their formation, with the geodynamics of regions and global factors affecting the sedimentation environment; techniques for restoring the immersion of sedimentation basins; methods for calculating the rate of denudation of areas of demolition and filling of sedimentation basins;  - Knowledge:  scientific and methodological foundations and algorithm of structural and genetic analysis of sedimentary formations; the main types of sedimentary basins; typical formation series of sedimentary basins; the largest sedimentary basins in the world; the role of the tectonic factor in the formation of hydrocarbon deposits.  -Ability:  to identify above-fertile geological bodies, reconstruct the conditions of their formation and determine lateral changes in their structure to predict the structure of natural reservoirs in the search, exploration and exploitation of various deposits;  reconstruct the history of the paleobasin development; evaluate the oil and gas potential of various types of sedimentary basins. |
| Content | Sinking of the Earth's crust and formation of sedimentary basins; stratigraphic record of isostasis, tectonic movements, eustasia and sedimentation style; sedimentary systems: distribution, transformation and modification related to the composition of sedimentary material, fluctuations in sea level; deep-sea sedimentary systems; types of sedimentary basins and geodynamic conditions of their formation. |
| Examination forms | A written exam of three questions. the 1st question is an essay on the proposed topic; the 2nd and 3rd questions are practical tasks. |

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| Requirements for training and exams | Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson. In case of absence from the lesson, the student is obliged to notify the teacher within a day and explain the plan for self-study of the lesson; mandatory reading of the submitted materials before the lesson;   * delivery of tasks on time. There are penalties of -10% for late delivery; * 20% non-participation in the audience (for a good reason with 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 is welcome, but it is unacceptable to use them in the exam. |
| List of literature | Maslov A.V., Alekseev V.B. Sedimentary formations and sedimentary basins: study guide – Yekaterinburg: UGGA, 2003. – 203 s  Nikishin A.M.Global geodynamics. Moscow 2014. Nikishin A.M. Types of sedimentary basins. Presentations  Lobkovsky L. I., Nikishin A.M., Khain V. E. Modern problems of geotectonics and geodynamics. – M.: Scientific World, 2004. – 610 p.  Foreign and Russian literature in the discipline of Sedimentary Basin Analysis from 2018 to 2023.  Sedimentary Basin Analysis: Principles and Applications, 2nd Edition, by Robert G. Walker and J. Stanley Sneider (2018).  Principles of Basin and Petroleum Systems Modeling, 2nd Edition, by Mark D. Zoback and Michael D. Zyvoloski (2019).  Basin Analysis, Principles and Applications, 3rd Edition, by Larry J. Thomas (2020).  Petroleum Geology of Sedimentary Basins: From Turbidite System to Hydrocarbon Systems, 2nd Edition, by Graham C. Bury (2021).  Sedimentary Basin Analysis: Process and Products, by Stephen M. Hubbard (2022).  Sedimentary Basin Analysis with BasinMod: A Practical Guide, by J.K. Warren (2023).. Sedimentary Basin Analysis: Principles, Methods and Applications, by N.V. Khmeleva (2018).  "Sedimentary Basin Evolution: Methods and Tools for Interpretation" by V.G. Safonov and D.A. Sorokin (2023). |

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| Module designation | **GEO287 Organic geochemistry and paleobiomarkers** |
| Semester(s) in which the module is taught | 1st semester |
| Person responsible for the module | Tolganay Jarassova,  senior lecturer at HEaPG Department |
| Language | Russian |
| Attitude towards the curriculum | Profile (P) |
| Teaching methods | Theory and case studies, presentations, discussions, practical learning |
| Workload (incl. contact hours, self-employment hours) | ((Estimated) Total workload: 5 credits  Contact hours (please indicate if there will be a lecture, exercise, lab, etc.): 45h (30h lectures, 15h practical classes)  Hours per week: 3h (2h lectures, 1h practical classe)  Private training, including exam preparation, specified in hours 24 : 15h |
| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the module | Availability of a computer and computer equipment. Availability of an Internet channel with a speed of at least 0.5 Mbit/sec. A personal account with a photo of the person on the avatar and corporate email on the Microsoft 365 platform. Attendance of classes is mandatory according to the schedule. |
| Module objectives/intended learning outcomes | The purpose of teaching the discipline "Organic geochemistry and paleobiomarkers" is to study by undergraduates the issues of the origin of oil, sources of hydrocarbons in the subsoil, the role of sedimentary strata and fossil organic matter in the formation of oil and gas accumulations, types of high-molecular hydrocarbon compounds inherited from living organisms, biomolecular compounds, the concept of an oil system , correlation of oils and organic matter residues based on paleobiomarkers, increasing the efficiency of the study of sedimentary basins to identify areas promising for oil and gas.  Master student should be able to:  – understand the mechanism and sequence of transformations of organic matter into oil and gas;  – understand the principles of geochemical oil and gas exploration;  – to see the prospects for discovering new deposits  At the end of the course the student should know:  – the main classical and modern hypotheses of the origin of oil;  – structure of the main oil and gas complexes and their elements;  - composition, properties of oils and their relationship with the quality and price of oil;  – methods for assessing the maturity and generation potential of rocks;  - the main geochemical methods for searching for oil and gas fields, their tasks and content at the regional and exploration stage;  – types and forms of oil and gas migration in rocks, driving forces of migration;  – the concept of caustobilites and their genetic classification;  – processes of oil transformation in deposits. |
| Content | General information about the formation of organic substances and oil. Geochemistry of oil. Oil composition (elemental, group, fractional) physical and chemical properties of oils, their classification. Heteroelements in oils. Structures inherited from organic matter. Geochemical evolution of oils. Changes in their properties under the influence of various geological and geochemical factors. Evolution of organic matter in lithogenesis. Conditions for the accumulation of organic matter and its transformation in diagenesis. Influence of diagenetic transformations of organic matter on the formation of the generation potential of oil source deposits. Transformation of organic matter in catagenesis. Vertical zoning of oil and gas formation processes. Metagenesis. Geochemical methods for predicting oil and gas content |
| Exam forms | Essay-type questions (long answers), multiple choice questions, matching, short answer questions, gap-filling, calculation |
| Tuition and Exam Requirements | Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson. AT  The undergraduate must come prepared for lectures and practical exercises. Timely protection and full performance of all types of work (practical and independent) are required. |
| Bibliography | L.I. Bogorodskaya, A.E. Kantorovich, A.I. Larichev, 2015. Methods of study, geochemical interpretation. Novosibirsk publishing house sb ras branch, 256 pp.  O.K. Bazhenova, Yu.K. Burlin, B.A. Sokolov, V.E. Khain Geology and geochemistry of oil and gas. Moscow State University Publishing House, Moscow, 2010, 384 pages, UDC: 553.9 (071.1), ISBN: 5-211-04888-1  K.E. Peters, C.C. Walters and J.M. Moldowan, 2007. The Biomarker Guide, Vol. 2: Biomarkers and Isotopes in Petroleum Exploration and Earth History, 2nd ed., Cambridge University Press, Cambridge, 1155p.  B.P. Tissot, D.H. Welte, 1984, Petroleum formation and occurrence: second revised and enlarged edition, Springer-Verlag, Berlin Heidelberg  [Harry Dembicki](https://www.amazon.ca/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Harry+Dembicki&text=Harry+Dembicki&sort=relevancerank&search-alias=books-ca), 2016, Practical Petroleum Geochemistry for Exploration and Production, Elsevier  T.Jarassova, M.Altunsoy. Organic Geochemical Characteristics of Core Samples from Central Primorsk-Emba Province, Precaspian Basin, Kazakhstan. SPE Virtual Annual Caspian Technical Conference 5 - 7 October 2021 |

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| Module designation | **GEO703 Paleotemperature regimes of the oil, genesis and migration of hydrocarbons** |
| Semester(s) in which the module is taught | 2nd semester |
| Person responsible for the module | Tolganay Jarassova,  senior lecturer at HEaPG Department |
| Language | Russian |
| Attitude towards the curriculum | Profile (P) |
| Teaching methods | Theory and case studies, presentations, discussions, practical learning |
| Workload (incl. contact hours, self-employment hours) | ((Estimated) Total workload: 5 credits  Contact hours (please indicate if there will be a lecture, exercise, lab, etc.): 45h (30h lectures, 15h practical classes)  Hours per week: 3h (2h lectures, 1h practical classe)  Private training, including exam preparation, specified in hours 24 : 15h |
| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the module | Availability of a computer and computer equipment. Availability of an Internet channel with a speed of at least 0.5 Mbit/sec. A personal account with a photo of the person on the avatar and corporate email on the Microsoft 365 platform. Attendance of classes is mandatory according to the schedule. |
| Module objectives/intended learning outcomes | The purpose of the discipline is to provide undergraduates with basic knowledge about the composition, properties and origin of oil and gas, as well as about the conditions of formation, formation processes and patterns of placement of their accumulations.  Discipline tasks:  - formation of theoretical foundations for the formation of liquid and gaseous hydrocarbons in sedimentary rocks, their migration, formation of knowledge in order to develop geological and geochemical criteria that control the patterns of accumulation of organic matter in sediments during sedimentogenesis and its changes in diagenesis and catagenesis  - acquisition by students of the skills of independent analytical and research work with graphic, cartographic and other material;  - development of undergraduate skills in working with educational and scientific literature |
| Content | Geothermy of sedimentary rock basins. Sources of thermal energy Processes of heat and mass transfer in sedimentary basins. Thermal regime of sedimentary basins. Thermal regime of basins and conditions for the maturation of organic matter at different stages of development. Transformation of organic matter at the stages of lithogenesis. Sources of organic matter in sedimentogenesis. Transformation of organic matter at the stage of diagenesis. Transformation of organic matter at the stage of catagenesis. Oil systems. Formation of oil and gas deposits. Types of hydrocarbon migration. Processes of accumulation of hydrocarbons. Oil and gas fields. |
| Exam forms | Essay-type questions (long answers), multiple choice questions, matching, short answer questions, gap-filling |
| Tuition and Exam Requirements | Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson.  The undergraduate must come prepared for lectures and practical exercises. Timely protection and full performance of all types of work (practical and independent) are required. |
| Bibliography | A. V. Ezhova, 2016. Lithology: a textbook for applied undergraduate studies / A. V. Ezhova. - Moscow: Yurayt Publishing House, 101 p.  E. E. Kozhevnikova, 2020. Geology and geochemistry of oil and gas ; Perm State National Research University. – Electronic data. - Perm, 2.25 Mb; 90 p.  S.V. Malyshevaб 2015. Regional modeling of basins of various geodynamic types in connection with the forecast of their oil and gas potential. St. Petersburg, 137 pages  Yu.G. Leonov, Yu.A. Volozh, 2004. Sedimentary basins: methods of study, structure and evolution. M.: Scientific world, 526 p. Color. tab - 40 s.  I.I. Ammosov , V.I. Gorshkov, Grechishnikov N.P., Kalmykov G.S., 1977. Paleogeothermal criteria for the location of oil deposits. M., "Nedra", 156p.  M.V. Bordovskaya , A.S. Gadzhikasumov, A.A. Kartsev, 1989. Fundamentals of geochemistry, geochemical methods of prospecting, exploration and control over the development of oil and gas fields. – M.: Nedra, 245 p. |

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| Module designation | **GEO745 Depositional environments and facies during the formation of oil and gas deposits** |
| Semester(s) in which the module is taught | 3rd semester |
| Person responsible for the module | Tolganay Jarassova,  senior lecturer at HEaPG Department |
| Language | Russian |
| Attitude towards the curriculum | Profile (P) |
| Teaching methods | Presentations, discussions, practical learning |
| Workload (incl. contact hours, self-employment hours) | ((Estimated) Total workload: 5 credits  Contact hours (please indicate if there will be a lecture, exercise, lab, etc.): 45h (30h lectures, 15h practical classes)  Hours per week: 3h (2h lectures, 1h practical classe)  Private training, including exam preparation, specified in hours 24 : 15h |
| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the module | Availability of a computer and computer equipment. Availability of an Internet channel with a speed of at least 0.5 Mbit/sec. A personal account with a photo of the person on the avatar and corporate email on the Microsoft 365 platform. Attendance of classes is mandatory according to the schedule. |
| Module objectives/intended learning outcomes | Study of the classification of sedimentary rocks, types of lithogenesis, methods of lithological study of rocks, generalization of analytical data, main stages of formation and transformation of sedimentary rocks, methods of facies analysis, conditions of sedimentogenesis.  Master student should be able to:   * identify and describe material and structural-textural features of sediments and sedimentary rocks; * to use the granulometric method for studying sedimentary rocks and to know its possibilities for the nomenclature and genetic interpretation of the environments of their formation;   At the end of the course the student should know:   * methodology for studying precipitation and modern methods for their study; * material composition of sediments, textural and structural features; * features of the formation of sediments and sedimentary rocks; * the influence of ancient and modern landscape and climatic conditions on the formation of sedimentary rocks; * methods of paleogeographic research; * fundamentals of facies analysis. |
| Content | A facies, as the smallest indivisible unit of a landscape, as a modern or ancient depositional setting. Analysis of the conditions for the formation of sedimentary material.  Facies classification. Groups of marine, continental and transitional facies, their geological characteristics and methods of separation.  When studying the discipline and obtaining skills and abilities to work with sediments and their rock formations, a cycle of practical work is performed. |
| Exam forms | Essay-type questions (long answers), multiple choice questions, matching, short answer questions, gap-filling |
| Tuition and Exam Requirements | Mandatory participation in training sessions according to the schedule, which determines the readiness for the lesson. AT  The undergraduate must come prepared for lectures and practical exercises. Timely protection and full performance of all types of work (practical and independent) are required. |
| Bibliography | A.I. Malinovsky, 2013. Fundamentals of lithology. Tutorial. - Vladivostok, Dal science, 188 p.  Z.V. Sterlenko, K.V. Umanzhinova, 2016. Lithology. Edition: NCFU, Stavropol, 219 pages, UDC: 550.8 (075.8).  [Somasankara Rao Koppisetti,](https://www.amazon.ca/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Somasankara+Rao+Koppisetti&text=Somasankara+Rao+Koppisetti&sort=relevancerank&search-alias=books-ca) Understanding of Depositional Environment of Sedimentary Basins: Sedimentary Facies and Environments. LAP LAMBERT Academic Publishing, 2017  Sterlenko Z.V. , Umanzhinova K.V. Lithology. Edition: NCFU, Stavropol, 2016.  Ezhova, A. V. Lithology: a textbook for applied undergraduate studies / A. V. Ezhova. - Moscow: Yurayt Publishing House, 2016.  Di Hu, Song Rao, Zhu‑Ting Wang, Sheng‑Biao Hu. Thermal and maturation history for Carboniferous source rocks in the Junggar Basin, Northwest China: implications for hydrocarbon exploration. Petroleum Science, 2020. |

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| Module designation | GEO 700 Aerospace methods in the search and exploration of oil and gas fields |
| Semester(s) in which this module is taught | autumn |
| The person responsible  for the module | Urmanova Dilyara Eldarovna, lecturer, senior researcher |
| Language | Russian, English |
| Attitude to the curriculum | Profile (P) |
| Teaching methods | lecture, practice |
| Workload (incl. contact hours, hours of independent work) | ((Estimated) Total workload: 3 cr  Contact hours (please indicate whether there will be a lecture, exercise, laboratory session, etc.): 45h  Private training, including exam preparation, specified in hours 24 : 15h |

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| Credit scores | 5 (2/0/1/2) |
| Necessary and recommended prerequisites for joining the  module | oil and gas field geology and reserves calculation |

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| Module objectives/expected learning outcomes | * Knowledge: familiarity with information, theory and/or subject knowledge related to working with aerospace images, the principles of their decoding and identification of patterns of oil and gas occurrence   Skills: cognitive and practical abilities, which use knowledge on the use of QGIS free access software, working with the USGS aerospace imagery database, etc.   * Competencies: integration of knowledge, skills and social and methodological capabilities in work or study   situations25, for example: “Students are able to independently work with the material of various databases of aerospace images, process data, analyze and come to conclusions upon completion of the analysis, as well as conduct a comparative analysis of aerospace images of various survey areas with different geological conditions” |
| Content | The course is intended for undergraduates of the OP "Geology and exploration of mineral deposits", "Geology of oil and gas".  The purpose is to acquire theoretical and practical knowledge of the principles of application of aerospace methods of oil and gas geology in the search for oil and gas deposits, familiarization with the methods of oil and gas geological interpretation in various geographical and geological conditions. |
| Examination forms | The answers are written if the exam is online, oral if offline. 3 questions: 2 theoretical, 1 practical-analysis and decoding of aerospace images |
| Requirements for training and exams | To successfully complete the course, a master's student needs to decrypt, analyze the aerospace images of the territory of 3 oil fields in various spectra, protect the work on the imposition of isolines on aerospace images using QGis software, protect 2 presentations on the subject of the course determined by the lecturer.  The exam is conducted online during the Covid-19 pandemic restrictions by working in Microsoft teams, subject to the mandatory condition of the camera being turned on, a proctor is present at the exam, who monitors the behavior of students during the exam for academic integrity.  The exam is conducted offline outside of the Covid-19 pandemic restriction period, during which undergraduates answer 3 questions in tickets: 2 of a theoretical nature, 1 practical-such as analysis and decoding of an aerospace image. |

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| List of literature | 1. 1. Trofimov D.M. et al. Modern methods and algorithms for processing space, geological, geophysical and geochemical information for predicting the hydrocarbon potential of unexplored subsurface areas. M., Fizmatlit, 2012 2. 2. Gafarov N.A. et al. The use of space information in the gas industry.Moscow,: Gazprom Expo LLC, 2010, - 132 p 3. 3. Korchuganova N.I. Aerospace methods in geology. Moscow: Geokart, GEOS, 2006 4. Stevens P. Kuwait Petroleum Corporation: Searching for Strategy in fragmented oil sector, Program on energy and sustainable development, 2008 5. Zabota B. et al. Accuracy Assessment of UAV- Photogrammetric-DerivedProducts Using PPK and GCPs in Challenging Terrains: InSearch of Optimized Rockfall Mapping. Remote sensing, 2021 6. Granado C. et al. 3D crustal‑ scale structure of the West Iberia margin: a novel approach to integrated structural characterization of passive margins. Marine geophysical research. 2021 7. Kazemi N. et al. Advancedsensingandimagingforefficientenergyexplo rationincomplexreservoirs. Enerhy reports.2020 8. Cotugno A. et al. A Framework for Calculating Peak Discharge and FloodInundation in Ungauged Urban Watersheds Using RemotelySensed Precipitation Data: A Case Study in Freetown,Sierra Leone. Remote sensing, 2021 9. Sun Yu et al. Alteration Hydrothermal Stage Division and its Application in Geological Prospecting Using CASI-SASI Airborne Hyperspectral Data: Taken the Baixianishan Area in Liuyuan Town of Gansu Province as an Example IOP Conference Series: Earth and Environmental Science, 2019 International Conference on Oil & Gas Engineering and Geological Sciences 10. Dzhevaga N. et al. Analysis of Air Monitoring System in Megacity on the Example of St. Petersburg. Journal of Ecological Engineering. 2021 |