| | |
|---|---|
| **Course title** | Gas and oil pipelines and gas and oil storage facilities (ECTS 4) |
| **Course/module code** | GNOGNQ3504 |
| Semester in which the course is taught | Semester 3/5 |
| Assigned instructor | Tasmatov Norpulat Umarqulovich<br>Associate Professor |
| Language of instruction | Uzbek |
| Course type | Elective |
| Study hours (including independent study) | Total: 120 hours<br>Classroom hours: 48 hours<br>Lectures: 24 hours<br>Practical classes: 24 hours<br>Independent study: 72 hours |
| ECTS | 4 ECTS |
| Course aims and objectives / learning outcomes | Course aim: to build in students theoretical knowledge and practical skills in gas and oil pipelines and gas and oil storage facilities, in delivering gas, oil and oil products to consumers through pipelines, and in designing, calculating, constructing, installing, technically operating and safely managing systems for storing gas, gas-processing products and oil products at gas and oil depots. The course also introduces students to the structure of gas and oil pipelines, hydraulic operating modes, pump and compressor stations, reservoirs, process equipment, and automation and control systems, and prepares them to apply modern, energy-saving and environmentally safe technologies.<br>Course objectives:<br>- to study the physical and mechanical properties of gas, oil and their products and their effect on pipeline transport;<br>- to study the classification, structure and process schemes of gas and oil pipelines and gas and oil depots;<br>- to master the basic principles and regulatory requirements for designing gas and oil pipelines, depots and reservoirs;<br>- to learn to calculate the diameter, capacity, pressure losses and hydraulic modes of trunk gas and oil pipelines;<br>- to study the structure, operating principle and selection methods of pump stations on oil and oil product pipelines and compressor stations on trunk gas pipelines;<br>- to develop skills in selecting and applying fittings, shut-off and control devices, measuring devices and protective devices on gas, oil and oil product pipelines;<br>- to study technologies for laying gas, oil and oil product pipelines underground and aboveground;<br>- to master methods of corrosion protection, technical diagnostics and monitoring of underground and crossing pipelines;<br>- to become familiar with gas, oil and oil product depots, reservoirs and their main process equipment;<br>- to study methods of reducing losses during storage at gas and oil product depots;<br>- to learn the requirements for ensuring accident, fire and explosion safety of gas, oil and oil product pipelines and depots;<br>- to master methods of ensuring energy efficiency and environmental safety in the delivery of gas, oil and oil products.<br>Learning outcomes:<br>1. Knows the structure, operating principle and process of transport systems for gas, oil and oil products and of their storage systems.<br>2. Is able to determine and analyse the hydraulic, technological and structural parameters of gas and oil pipelines.<br>3. Has the competence to select pipe diameter, working pressure, capacity and other main technical parameters.<br>4. Is able to select trunk pump and compressor stations on the basis of technological and hydraulic requirements.<br>5. Acquires the competence to select the type, volume, number and process scheme of gas, oil and oil product depots and reservoirs. |
| Course content (topics) | Main theoretical part (lectures) – 24 hours:<br>Topic 1. Aims of the course “Gas and oil pipelines and gas and oil storage facilities” and its links with other subjects; current state and future. Supply of gas, oil and oil products; stages of development of gas and oil pipelines and storage facilities. Basic principles of |

| | |
|---|---|
| | designing, constructing and operating pipeline systems for the supply of gas, oil and oil products. [1,2,3] — 2 hours<br>Topic 2. Characteristics of oil and oil products. Main characteristics of oil and oil products. Physical properties of oil and oil products: specific gravity, viscosity, heat capacity, evaporation, pour point, expansion coefficient, ignition temperature. [1,2,3] — 2 hours<br>Topic 3. Properties of natural and liquefied gases. Main classifications of gases. Properties of natural gases. Main classifications of liquefied gas. Density and properties of combustible gases. Storage of natural and liquefied gases and their schemes. [1,2,3] — 2 hours<br>Topic 4. Methods of prospecting for and producing oil and gas. Movement of oil and gas in porous media. Types of gas and oil fields. Oil and gas gathering facilities at gas and oil fields. Oil and gas deposits. Estimation of the gas compressibility factor. [1,2,3] — 2 hours<br>Topic 5. Structure, classification and main process schemes of oil and gas pipeline systems. Trunk gas pipelines. Classification of trunk pipelines. Methods of gas delivery through trunk pipelines. Gate valves, valves and cocks. [1,2,3] — 2 hours<br>Topic 6. Measurement of consumption of gas, oil and oil products. Measurement of gas flow with an orifice meter. Design of trunk gas pipelines. Tasks in designing trunk gas and oil pipelines. Hydraulic calculation of trunk pipelines. [1,2,3] — 2 hours<br>Topic 7. Gas and oil pipelines and their fittings; gas transmission systems. Classification of pipelines for gas, oil and oil products. Pipe laying. Pipes used for transporting oil, oil products and gas. [1,2,3] — 2 hours<br>Topic 8. Storage of gas, oil and oil products. Types, construction, process equipment and safe operation of gas depots and oil depots. Main operations carried out at gas and oil depots. Design of oil depots: general required information, design assignment, procedure for selecting the construction site. [1,2,3] — 2 hours<br>Topic 9. Gas storage facilities: types of gas depots, selecting the construction site and area. Master plan of a gas or oil depot. Classification of the processes taking place there. Procedure for selecting the construction site for oil and gas depots and reservoirs; selecting the site and preparing the necessary data. [1,2,3] — 2 hours<br>Topic 10. Receiving and storing oil and oil products. Transport for delivering products. Receiving and distributing depots. Technical and economic indicators of railway tank cars. Systems for unloading oil products from railway tank cars. Pressure unloading. Standards for unloading duration. [1,2,3] — 2 hours<br>Topic 11. Reservoirs for oil and oil products. Reservoirs for storing oil and oil products. General information and classification of reservoirs. Types of reservoirs. Ideal reservoir model. Aboveground metal reservoirs. Steel vertical cylindrical reservoirs. [1,2,3] — 2 hours<br>Topic 12. Selecting the optimal route for gas and oil pipelines. Artificial and natural obstacles. Classification of obstacles. Conditions for constructing pipelines in difficult terrain. Laying pipelines under water. Laying pipelines across railways and roads. [1,2,3] — 2 hours<br><br>Guidelines and recommendations for practical classes – 24 hours:<br>The teacher's preparation for a practical class begins with studying the initial documents (curriculum, thematic plan, etc.) and ends with drawing up the lesson plan. The teacher must have a clear idea of the aims and objectives of the practical class and of the amount of work each student must complete. The methodological guidelines are the teacher's main methodological document for preparing and conducting practical classes. The aim of a practical class is to understand the theory and acquire skills, to apply them consciously in study and professional activity, and to develop the ability to form and defend one's own point of view with confidence.<br>Recommended practical topics:<br>1. Studying the chemical and physical parameters of oil and oil products — 2 hours<br>2. Studying the physical parameters of natural and artificial gases — 2 hours<br>3. Carrying out the process calculation of trunk gas pipelines — 2 hours<br>4. Process calculation of oil and oil product storage depots — 2 hours<br>5. Calculating the gas storage volume and gas withdrawal in an underground gas storage facility — 2 hours<br>6. Hydraulic calculation of receiving and distribution pipelines at oil depots — 2 hours<br>7. Hydraulic calculation of gas, oil and oil product pipelines — 2 hours<br>8. Determining the optimal diameter of trunk, distribution and network gas pipelines — 2 hours<br>9. Determining and eliminating the unevenness of seasonal gas consumption — 2 hours<br>10. Use and operation of gas and oil pipelines — 2 hours<br>11. Cleaning methods during the operation of gas and oil pipelines — 2 hours |

| | |
|---|---|
| | 12. Procedure for repairs and elimination of accidents on gas pipelines — 2 hours<br><br>Independent study and independent work – 72 hours:<br>The independent study competence helps students develop themselves independently and improves the effectiveness of their professional activity. Students complete independent assignments on their mobile devices under the teacher's guidance, in traditional or electronic form.<br>Recommended topics for independent study:<br>IS1. Evaporation of oil and oil products in reservoirs and methods of reducing product losses<br>IS2. Use of pumping, measuring and control devices at oil and oil product depots<br>IS3. Environmental safety and environmental protection of gas and oil pipelines and depots<br>IS4. Purpose, classification and structure of gas and oil pipelines and their role in the modern transport system<br>IS5. Process schemes and main structural elements of trunk gas pipelines<br>IS6. Structure and operating principle of oil and oil product pipelines<br>IS7. Physical and mechanical properties of natural gas and oil and their effect on pipeline transport<br>IS8. Selecting pipe diameter, pressure and capacity in the design of gas pipelines<br>IS9. Hydraulic calculation of gas pipelines and methods of determining pressure losses<br>IS10. Hydraulic calculation of oil pipelines; determining hydraulic resistances and pressure losses<br>IS11. Structure, purpose and operating principle of compressor stations on trunk gas pipelines<br>IS12. Structure and process equipment of pumping stations on trunk oil pipelines<br>IS13. Use of valves, shut-off and control devices and protective devices in gas and oil pipelines<br>IS14. Technologies for underground and aboveground laying of gas and oil pipelines<br>IS15. Modern methods of corrosion protection of gas and oil pipelines and cathodic protection<br>IS16. Technical diagnostics and monitoring of gas and oil pipelines and methods of detecting leaks<br>IS17. Accidents on gas and oil pipelines, their causes and methods of elimination<br>IS18. Automation, telemechanics and SCADA monitoring systems in gas and oil pipelines<br>IS19. Purpose, classification, process schemes and main equipment of gas, oil and oil product depots<br>IS20. Types, construction and selection principles of reservoirs for storing oil and oil products<br>IS21. Liquefied gas storage reservoirs, their structural and operational features<br>IS22. Calculating, selecting and siting the volume of a reservoir farm at oil depots<br>IS23. Use of energy-saving and digital technologies in gas and oil transport pipeline systems<br>IS24. Problems of operating gas and oil pipelines and depots in Uzbekistan and ways to improve them |
| Student assessment | Assessment is based on students' mastery of the teaching material (results of tests, assignments, and written and oral work) during the semester and in the final assessment. In studying the course "Gas and oil pipelines and gas and oil storage facilities", students are assessed on a 100-point scale.<br>50 points are allocated to continuous and midterm results (of these 50 points, 60% is continuous assessment and independent study, and 40% is midterm assessment), and 50 points to the final assessment.<br>Students whose total continuous and midterm score is below 30 points are not admitted to the final examination. A student who scores 30 or more points in the final assessment is considered to have passed the course. |
| Requirements for admission to examinations | The student must have fully mastered the theoretical and practical concepts of the subject and be able to present the results of analysis correctly. The student must have completed the assignments given in independent study and in the continuous and midterm forms of assessment. In addition, within the set time the student must have earned sufficient points from the continuous, midterm, independent study and final assessments.<br>A student who has not submitted the continuous assessment, midterm assessment and independent study assignments, or who has earned fewer than 30 points in these assignments and types of assessment, is not admitted to the final assessment. A student who, without a valid reason, misses 25% or more of the classroom hours allocated to the course is removed from the course, is not admitted to the final examination and is |

| | |
|---|---|
| | considered not to have earned the credits for the course. A student who fails the final examination or scores in the range "0–29.9" in these examinations is considered an academic debtor. |
| Recommended references | Core references:<br>1. N. U. Toshmatov. Gas and Oil Pipelines and Gas and Oil Storage Facilities. Study guide. Jizzakh, 2023. 134 pp.<br>2. N. U. Toshmatov. Heat and Gas Supply Systems. Textbook. Tashkent, 2021. 174 pp.<br>3. Aymatov R., Boboyev S., Alibekov J. Gas Supply. Study guide. Jizzakh, 2003. 170 pp.<br>4. Aliev B. A., Buranov M. D. Transport and Storage of Oil, Oil Products and Gas. TSTU, Tashkent, 2006. Study guide (in Russian).<br>Additional references:<br>5. Rashidov Yu. K. Heat and Gas Supply and Ventilation. Textbook. Tashkent, 2009.<br>6. Ionin A. A. Gas Supply. 4th ed. Moscow: Stroyizdat, 1988. 439 pp. (in Russian).<br>7. Rashidov Yu. K. Gas Supply. TAQI, 2000. 79 pp.<br>8. Shadrina A. B. Construction and Operation of Gas and Oil Pipelines and Gas and Oil Storage Facilities. Nedra, 2012 (in Russian).<br>9. Aliev R. A., Belousov V. D., Nemudrov A. G., Yufin V. A., Yakovlev E. I. Pipeline Transport of Oil and Gas. Textbook for universities. 2nd ed., 1988 (in Russian).<br>Internet resources:<br>10. www.gov.uz – Government portal of the Republic of Uzbekistan.<br>11. www.lex.uz – National Database of Legislation of the Republic of Uzbekistan.<br>12. www.mc.uz – Ministry of Construction and Housing and Communal Services of the Republic of Uzbekistan.<br>13. www.ZiyoNet.uz<br>14. www.setkov-psk.perm.ru<br>15. www.twirpx.com |

**Syllabus topics adopted on the basis of TOP 300 (QS/THE) university curricula:**

| № | Name of the HEI | QS | THE | Topic name in this syllabus | Additional topics introduced on the basis of the TOP 300 educational programme | Links |
|---|---|---|---|---|---|---|
| **1** | City University of Hong Kong (ranked 63rd), based on the course "Heating, Gas Supply, Ventilation and Air Conditioning Engineering" | **63** | **106** | Topic 5. Structure, classification and main process schemes of oil and gas pipeline systems. | Develop the fundamental principles of two-phase heat transfer. | https://www.cityu.edu.hk/catalogue/ug/202223/course/MNE4130.pdf |
| | | | | Topic 8. Storage of energy resources. Gas depots: types, design, process equipment and safe operation. | Develop the problem-solving skills essential to good engineering practice of two-phase heat transfer in real-world applications. | |