Name of science	**Chemical Technology (ECTS 4)**
Subject/module code	CT 304
Semester(s) in which the subject is taught .	*3 semesters*
Responsible teacher	Sharifov Gulomjon Nabiyevich , associate professor (PhD)
Language of instruction	*Uzbek*
Connect to the curriculum	*Optional*
Study hours (including contact hours, independent study)	**Total hours - 120.** **Auditory training hours - 60.** Lecture training hours – 30. Laboratory training hours – 30. **Independent study hours – 60.**
ECTS	*4*
Prerequisites/ Relationship to disciplines	General chemistry, inorganic chemistry, organic chemistry, analytical chemistry, physical and colloidal chemistry
Objectives/learning outcomes of the subject	The goal of teaching science is to see the harmony of science and production. The course introduces the most important chemical, metallurgical and fuel processing, and the basics of silicate production. In studying the chemistry course, special importance is given to chemical production. The task of the subject is to familiarize students with the basics of chemical technology, focusing on the characteristics of the chemical, metallurgical, oil and gas processing, silicate, organic synthesis, synthetic fibers, and plastics production industries and processes in our Republic.
Course content (topics)	**I. Main theoretical part (lecture sessions) .** **Module 1. Purpose and function of chemical technology** Topic 1. Chemical technology is the subject of science and its important concepts. Topic 2. Raw materials and energy. The principle of recycling raw materials and production waste . Topic 3. Water. Water and its quality requirements **Module 2. Chemical acids and fertilizers.** Topic 4. Properties, uses and different types of sulfuric acid. Sulfuric acid production by contact and nitrous methods. Topic 5. Theoretical foundations of ammonia synthesis. Synthetic ammonia and Nitric acid production . Topic 6. Nitrogen fertilizers. Development of phosphorus and potassium fertilizers in industry . **Module 3. Silicate industry.** Topic 7. Silicate. Classification of products and materials , their importance in the national economy. Silicate industry. Topic 8. Cement production. Production and use of lime and building plaster **Module 4. Metallurgy.** Topic 9. Classification of metals. Ferrous and non-ferrous metallurgy. Topic 10. Iron and Steel Production . Topic 11. Production of aluminum and its alloys. Raw materials for gold production. **Module 5. Oil and natural gas.** Topic 12. Concepts of oil extraction methods. Oil refining . Topic 13. Composition and processing of petroleum gases and gases from oil refining. Natural gas . Topic 14. The emergence and development of the organic synthesis industry. Synthesis based on acetylene and aromatic compounds .

	Module 6. Plastics. Topic 15. Concept of high molecular weight compounds. Production of plastic materials (plastics). **II. Instructions and recommendations for organizing laboratory exercises** **Recommended topics for laboratory work:** **1- laboratory work.** Determining water hardness . **2 - laboratory work.** Obtaining sulfuric acid by oxidizing sulfur. Studying the catalytic oxidation of sulfur (IV) oxide to sulfur (VI) oxide. Laboratory **work 3.** Production of nitric acid by catalytic oxidation of ammonia **4 - laboratory work.** Preparation of simple and double superphosphate. Preparation of potassium chloride from sylvinite **5 - laboratory work.** Chemical and photocolorometric (assay) analysis of phosphorus fertilizers **6 - laboratory work.** Preparation of a liquid glass **7 - laboratory work.** Obtaining and testing building plaster. Making porcelain and earthenware products **8 - Laboratory work.** Flotation enrichment of solid raw materials **Laboratory work 9.** Electrolytic deposition of copper and nickel coatings on the surface of steel **products** . **10 - laboratory work.** Oxidation and phosphating of metals Determination of the resistance of metals to corrosion (rust) 11- **Laboratory work.** Synthesis of hydrogen chloride and production of hydrochloric acid. **Laboratory work** 12. Chromatographic analysis of gas and liquid mixtures (analytical) . 13- **laboratory work.** Oil and its processing. Cracking of petroleum products 14- **laboratory work.** Coking of coal 15 - **Laboratory work.** Obtaining acetate fibers . **IV. Independent learning and independent work .** The competence of independent learning serves to promote independent self-development of students and increase the effectiveness of professional activities. Students perform independent work on their own mobile devices, in traditional forms under the guidance of a teacher, and in electronic forms under the guidance of a teacher. **Recommended topics for independent study:** 1. The content and function of chemical technology. 2. Stages (periods) of development of chemical technology 3. Development of industrial branches of chemical technology. 4. Main directions of development of modern chemical technology. 5. Methods of increasing production capacity 6. Methods for increasing the speed of equipment. 7. The result of mechanization and automation of production. 8. Reduce production steps 9. Creating a waste-free, closed-loop technology 10. Ways to reduce energy consumption. 11. Economic indicators of chemical production 12. Method for determining the yield of a product 13. Raw material consumption 14. Production capacity 15. Ways to increase labor productivity

	16. Product cost 17. Indicators determining the quality of chemical products 18. Understanding the meaning of the word technology 19. General aspects of technology 20. What are the stages of chemical technological processes? 21. How are the stages of a chemical technological process organized ? 22. How is the rate of a chemical technological process determined ? 23. The concept of technological parameters-factors 24. How does the process proceed under the influence of optimal technological factors? 25. Explain the technological regime . 26. Concepts of raw materials, products, intermediate products, by-products, waste 27. What is the difference between continuous and discontinuous processes and what are the advantages of switching to a continuous process? 28. Chemical technological processes and equipment . 29. The rate of a chemical process, methods for determining it and factors affecting it 30. For what purposes is sulfuric acid used in industry and what are its properties ? 31. Raw material for the production of sulfuric acid . 32. Methods of producing sulfuric acid . 33. Technology for obtaining sulfur I V-oxide 34. The main factors affecting the rate of the process of obtaining sulfur I V-oxide 35. Methods for increasing the rate of sulfur I V-oxide production 36. What are the types of pyrite calcining furnaces, and what are their advantages and disadvantages ? 37. Stages of sulfuric acid production by contact method 38. What is the purpose of purifying sulfur dioxide ? 39. Sulfur I V-oxide purification equipment 40. Factors affecting the oxidation of $SO_{2\ to}SO_3$ 41. Factors affecting the rate of oxidation of $SO_{2\ to}SO_3$ 42. How is the process of sorption of SO_3 with water carried out from a technological point of view ? 43. Type of equipment that performs the process of oxidizing $SO_{2\ to}SO_3$ 44. Explain the technological scheme for obtaining sulfuric acid by the nitrosation method . 45. Compare the contact and nitrosyl methods of producing sulfuric acid and explain their advantages and disadvantages. 46. What are the uses of nitric acid in industry and its properties? 47. What methods do you know for producing nitric acid ? 48. Main sources of raw materials for the production of nitric acid 49. What methods do you know of to bind nitrogen in the air? 50. Give information about the electric arc method . 51. Talk about the calcium carbide method. 52. Give information about the ammonia method. 53. Indicate the advantages and disadvantages of natural nitrogen fixation using electric arc, ammonia, and calcium carbide methods. 54. Factors affecting the process of fixing natural nitrogen by the ammonia method 55. Discuss the technological scheme of ammonia production . 56. Nitric acid production stages 57. Describe the process of ammonia oxidation by contact method and the

	factors affecting this process. 58. Describe the process of oxidizing nitrogen dioxide to nitrogen dioxide and the factors affecting this process. 59. Describe the process of absorption of nitrogen dioxide into water and the factors affecting this process. 60. Side reactions occurring in the process of ammonia oxidation by contact method and methods for increasing the rate of the main reaction
Exam form	Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics . **1.Current control** The student's activity in daily classes is assessed through the student's mastery of course topics , as well as constructive interpretation and analysis of the educational material, development of module-specific skills, acquisition of practical skills (in terms of quality and the specified quantity) and competencies, solving problem situations aimed at applying professional practical skills, working in a team, preparing presentations , etc. Activity in lessons Preparation of educational materials Working with sources within the topic Use of educational technologies Teamwork Preparing presentations **2. Intermediate control:** Assessment of the student's knowledge and practical skills and level of mastery of lecture exercises after completing the relevant section of the course. is conducted during the semester during the academic sessions after the completion of the relevant module of the subject's curriculum . Intermediate control within this subject is carried out in one semester. 10 points are awarded for 1 written test **, and 10 points** are awarded for independent study. Midterm exam questions cover topics 1-15 of the subject. **Final inspection** The final type of control is conducted at the end of the semester to determine the level of mastery of the student's theoretical knowledge and practical skills in the relevant subject. The final inspection will be conducted at a designated time based on the inspection schedule created by the Registrar's Office on the electronic platform.
Educational outcomes and exam requirements	Complete mastery of theoretical and methodological concepts on the topic, the ability to correctly reflect the results of the analysis, independently reflect on the processes being studied, and complete tasks in current and intermediate forms of assessment, as well as tasks for final assessment . The student must have submitted current control, intermediate control, and independent learning assignments by the deadline for the final control in the relevant subject. A student who has not submitted current control, intermediate control, and independent learning assignments, as well as who has received a score in the range of "0-29.9" for these assignments and control type, will not be included in the final control type. Also, a student who misses 25 percent or more of the classroom hours allocated to a subject without a valid reason will be excluded from this subject, will not be included in the final examination, and will be considered not to have acquired the relevant credits in this subject. A student who has not taken the final examination or who has not taken it and has received a score in the range of "0-29.9" for this type of examination is considered an academic debtor.

	The final examination in this subject **is in written form.** is held in the form of. final exam consists of 5 questions, each of which is worth up to 10 points.
Recommended readings	1. Sh.M.Mirkomilov Chemical Technology Lecture Text. Nizamiy State Polytechnic University 2011 2. Kattaev N, M. Mukhammadiev, Kh. Mirzokhidov Chemical technology T-2008y 3. A.A. Ismatov, N.P. Ismoilov, F.M. Mirzaev Chemical technology of inorganic metals T. Uzbekistan. 2002. 4. Sh.M.Mirkomilov, XU Maksudkhonov, O.Iskandarov. Collection of practical works, problems - exercises and tests in the field of chemical technology. T.Universitet.2000. 5. NYSaidakhmedova Chemical technology textbook. Tashkent. 2021. 6. Chemical Process Technology [Paperback] Indra Deo Mall Paperback – 14 July 2023 https://amzn.in/d/0aUYiad 7. Babayev T. High molecular compounds. Tashkent. Science and Technology 2015. 8. Khamidov BN, Fozilov SF, Saidakhmedov Sh.M., Mavlanov BA, Oil and gas chemistry, Tashkent "Editor" - 2014. 9. Ataqo‘ziyev T.A., A.A. Ismatov, N.P. Ismoilov, F.M. Mirzaev "Chemical technology of inorganic metals" T. "Uzbekistan" 2002. 10. J. Isroilov. Fundamentals of technology of the most important branches of industry. T. O'kutty. 1978. 11. Sh.M. Mirkomilov Chemical Technology Lectures Text. Nizamiy State Technical University, 2000 12. RSokolov. Chemical technology v 2-x tomax. M. Humanitarian publishing center, Vlados, 2000. 13. Turobjonov SM, Mirkhamitova DX, Juraev VN, Nurmonov SE, Ziyadullaev OE, Oil and gas chemistry and physics, Tashkent, “Tafakkur bustoni”, 2014, 160 p. 14 . B. E. Abalonen. Basic chemical products. M., Chemistry-2000g. 471s. 15. Mirkomilov Sh.M., Bozorov NI, Ismailov II Polymer Chemistry. Tashkent: “Navruz”. 2013. 16 . Z. Salimov Basic processes and devices of chemical technology. T. "Uzbekistan" 1995.