**Faculty of Mechanics and Mathematics**

**Department Mathematical Modelling and Simulation**

**PROGRAM of "NUMERICAL SIMULATION OF UNSTEADY THREE-DIMENSIONAL TURBULENCE FLOWS"**

**Final exam**

**for the specialty "­­­­ 8D06104-Mathematical and Computer Modelling "**

**(fall semester, 2021/2022)**

**Almaty 2021**

**DEVELOPED:**

**ABDIBEKOV UALIKHAN CEIDILDAEVICH - professor**

PROGRAM of SUBJECT

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| 1. An introduction to modeling and simulation. |
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| 2. Matrix sweep method. |
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| 3. High-Order Fractional-Step Methods |
| 4. Time Discretizations. Adams-Bashforth Methods. Adams-Moulton Methods. |
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| 5. Furies Method for Three Dimensional Poisson Equations. |
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| 6. Three Classical filters for LES. |
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| 7. Decomposition of the non-linear term. Leonard’s decomposition. |
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| 8. Improvement of models in the physical space. Dynamic procedures for computing the constants. Germano-Lilly dynamic procedure. |
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| 9. Deterministic statistical models. Localized dinamic model with energy equation. |
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| 10. Anisotropic models. Model based on splitting technique. |
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| 11. Non-linear models. Dynamic non-linear model. |
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| 12. Scale similarity models. Dynamic similarity model. |
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| 13. Differential subgrid stress models. Deardorff model. Subgrid viscosity models. |
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| 14. Mixed modeling. One parameter mixed dynamic model. |
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| 15. Incompressible Navier-Stokes equations with turbulence models. |
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1. 2008\_Волков, Емельянов\_Моделирование крупных вихрей в расчетах турбулентных течений
2. kniga\_gdr\_modelirovanie\_turbulentn\_techeniy\_Ievlev\_1990
3. Lesieur 2005
4. Sagault
5. Роуч - Вычислительная гидродинамика

**CONSIDERED and APPROVED**

**at the meeting of the department from " " 2021, protocol №**