**MINISTRY OF EDUCATION AND SCIENCE OF REPUBLIC KAZAKHSTAN**

**AL-FARABI KAZAKH NATIONAL UNIVERSITY**

**FACULTY OF BIOLOGY AND BIOTECHNOLOGY**

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|  **Coordinated** Dean of faculty\_\_\_\_\_\_\_\_\_\_\_\_ Shalahmetova Т.М. «\_\_\_\_\_\_\_»\_\_\_\_\_\_\_\_\_\_\_\_\_2013  | Approvedon the meeting of Scientific and methodical Council of universityProtocol №\_6\_ from \_21\_\_06\_\_ 2013.Vice Rector for Academic Affairs\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Burkitbayev M.M."\_\_\_21\_\_\_"\_\_\_\_\_06\_\_\_\_\_ 2013. |

# EDUCATIONAL AND METHODICAL COMPLEX OF DISCIPLINE

### «Bioenergetics of microorganisms»

 (discipline name)

 for PhD

speciality –Biology «6D060700»

Form of studing \_\_\_\_\_\_

(daytime, correspondence)

**Аlmaty 2013**

EMC of discipline is made by Doctor of Biological Science, the professor the department chair of biotechnology Zayadan Bolatkhan Kazykhanovich

On the basis \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 (on the basis what documents)

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It is considered and recommended at faculty meeting \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

from «\_18\_\_» \_\_06\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2013 ., protocol №\_\_\_41\_

chair of biotechnology \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Zayadan B.К.

 (signature)

### It is recommended methodical Council (bureau) of faculty

«\_\_18»\_\_\_\_\_\_\_\_\_\_\_06\_\_ 2012 ., protocol №\_10\_

Chairman \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 (signature)

**MINISTRY OF EDUCATION AND SCIENCE OF REPUBLIC KAZAKHSTAN**

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#  Approved

 on the meeting of faculty academic council

 Protocol №\_\_\_\_from « \_\_\_\_»\_\_\_\_\_\_ 2013 year

Dean of faculty, Prof.\_\_\_\_\_\_\_\_\_ Shalahmetova T.М.

**SYLLABUS**

**professional elective**

discipline **«Bioenergetics of microorganisms»** \_2\_ credit

2 course, english, 3 semester

**Lecturer:** Zayadan Bolatkhan Kazychanovysh, doctor of biology science, professor, department chair of biotechnology

Phone: 3773334, 8-701 401-33-01

e-mail: bolatkhan@kaznu.kz

room.: 515

**Discipline PASSPORT:**

**Purpose:** Studying of problems and prospects of microbiological production of renewables: the lowest alcohols, acetone, methane, bioconversion of organic waste and vegetable raw materials and prospects of production alternative energy sources on the basis of phototrophic microorganisms.

**Tasks:** to acquaint with prospects of microbiological production of renewables and the main representatives of microorganisms for receiving bio-energetics;

to give information on the principles of cultivation of photosynthesizing microorganisms at continuous lighting and approaches of genetic engineering for increase of efficiency of phototrophic microorganisms;

to acquaint with alternative energy sources on the basis of phototrophic microorganisms, and also with microbiological production of hydrogen.

When studying discipline doctoral candidates have to acquire knowledge of complete approach to studying of cells and the organisms, including physiology, biochemistry, genetics and molecular biology, to have idea of possibility of use of microorganisms for receiving renewable power sources.

 **Results of studing on the module:** doctoral candidates have to be able to approach from scientific and rational positions to questions of a choice of strategy of the solution of processing of organic and household waste on synthesis of gas which goes on synthesis of hydrocarbons and ethanol further. To know fast-growing needs for energy, resource problems and atmosphere pollution by combustion products that draws attention of the various states in renewables - winds, the sun and biofuels. Doctoral candidates have to have idea of opportunities, prospects and a problem of replacement of oil fuel biofuel, phytogenesis fuel. Listeners have to receive skills and knowledge of bases of practical application of phototrophic microorganisms for receiving a new type of fuel - biofuels. Receiving and development of technology of cultivation of active strains of microalgae – oil producers for production of the fuel biodiesel.

**STRUCTURE, VOLUME AND CONTENT OF DISCIPLINE**

|  |  |
| --- | --- |
| **week** | **Discipline «Bioenergetics of microorganisms», 2 credits** |
| **Name of theme** | **hour** | **estimation** |
| **Tematical blok I****Bioenergetics on the basis of microorganisms** |
| 1 | **Lecture 1.**  Bioenergetics and 21 century**Seminar occupation 1**. Biofuel of the second generation | 11 | 6 |
| 2 | **lecture 2.** Bioenergetics of microorganisms. Prospects **Seminar occupation 2** Biofuel of the generation SDW **1.**Biofuels on the basis of microorganisms | 11 | 620 |
| 3-4 | **Lecture 3-4. Biogas alternative energy of future** **Seminar occupation 3-4** Processing of solid household waste for receiving biofuel | 22 | 6 |
| 5-6 | **Lecture 5 – 6.**  Bioproduction of bioethanol **Seminar occupation 5-6** Production of biometanol**SDW 2.** Main producers of biofuel | 22 | 620 |
| 7 | **Lecture 7.** Production of hydrogen energy from bacteria**Seminar occupation 7** Opportunity and prospects of production hydrogen energy  | 11 | 6 |
| 8 | **Lecture 8.** Production of biooil**Seminar occupation 8** Biobutanol from biomass of microorganisms | 11 | 6 |
|  | **Intermediate Control**  |  | 18 |
|  | **summary** |  | 100 |
| **Tematical blok II****Bioenergetics on the basis of phototrophic microorganisms** |
| 9-10 | **Lecture 9-10.** Photobiotechnology in bioenergetics **Seminar occupation 9 -10** Biofuels from microalgae  | 22 | 6 |
| 11-12 | Lecture 11-12. Production of biodiesel from microalgae **Seminar occupation**  **11-12** Thetechnology of production of liquid biodiesel fuel**SDW 3.** Bioenergetics as resistance and renewable a source energy for Kazakhstan | 22 | 620 |
| 13 | Lecture 13 Production hydrogen energy from microalgaeSeminar occupation 13 – Microalgae -*Chlamydomonas reinhardtii* prospective object for production of hydrogen energy | 11 | 6 |
| 14 |  **Lecture 14** Production of biofuels from cyanobacteria**Seminar occupation 14** Mass cultivation of phototrophic microorganisms **SDW 4.** Approaches genetical engineering in production biofuels from microorganisms | 11 | 620 |
| 15 | **Lecture 15** Wasteless technology production of biodiesel **Seminar occupation 15** Mass cultivation of phototrophic microorganisms | 11 | 6 |
|  | **Intermediate Control**  |  | **18** |
|  | **summary** |  | **100** |

**Key concepts of discipline of system of knowledge and competences:** (List of the main concepts, processes, phenomena necessary for assimilation of the content of discipline and formation of competences).

**References**

**Main:**

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2. Кондратьева Е.Н., Максимова И.В., Самуилова В.Д. Фототрофные микроорганизмы: Учеб. пособие. - М.: МГУ, 1989.-376с
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14. Jon E. Smith. Biotechnology Cambridge university press, 2009
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**Additional:**

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| 1. Роль микроорганизмов в круговороте газов в природе. Под ред., Заварзина Г.И. М., 1979.
2. Стейниер Р., Эдельберг Э., Ингрем Д. Мир микробов (в 3-х томах). М.: Мир, 1979.
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4. Шлегель Г. Общая микробиология. М.: Мир, 1987, 567 с.
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2. Заварзин Г.А. Микробный геохимический цикл кальция. *Микробиология* 71 (2002) 5-22.
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**Tasks and methodical recommendations about SDW / SDWT.**

**Forms of control of knowledge and competences:**

**Examinations: \_\_\_ works in a semester.**

SDW: *individual and group tasks depending on technology of the SDW organization (the paper, presentation, the essay, protection of the project, the state-of-the-art review, etc. tasks of design and research character).*

Intermediate control: examination in the period of examinations.

Intermediate control is carried out on the theoretical and practical questions entering into the content of discipline (in 7, 8 weeks).

Advice on disciplines of the module it is possible to get office hours of the teacher (SDW) in time.

**Cryteria of an assessment of knowledge and competences, points in %**

|  |  |  |  |
| --- | --- | --- | --- |
| № | Types of work PhD | Number of points | % |
| 1 | Seminar1-7 week | 7 (week) x 6=42 |  |
| 2 | SW of PhD 4, 6 weeks | 2x20=40 |  |
| 3 | **I Intermediate work 7 week** | 18 |  |
| 4 | **Sum** | **100** | **100** |
| 5 | Seminar 8-15 week | 7аптаx6=42 |  |
| 6 | SW of PhD 9, 13 week | 2x20=40 |  |
| 7 | **II Intermediate work 15 week** | 18 |  |
| 8 | **Sum** | **100** | **100** |
| 9 | Max(100+100)/2=100 | **50** |  |
| 10 | **Examination** | Max 100 |  |
| 11 | **Summary points of discipline** | Max100Min 50 | **100** |

Summary points of discipline =IW1+IW2/2х0,6+examinationх0,4

**Scale of knowledge estimation:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Estimation by letter systems**  | **Estimation by number systems** | **Grade,** **%** | **Estimation by traditional systems** |
| А | 4,0 | 95-100 | Excellent |
| А- | 3,67 | 90-94 |
| В+ | 3,33 | 85-89 | Good/well |
| В | 3,0 | 80-84 |
| В- | 2,67 | 75-79 |
| С+ | 2,33 | 70-74 | Satisfactory |
| С | 2,0 | 65-69 |
| С- | 1,67 | 60-64 |
| D+ | 1,33 | 55-59 |
| D | 1,0 | 50-54 |
| F | 0 | 0-49 | Unsatisfactory |
| I  | - | - | Incomplete |
| P | - | 0-6065-100 | Pass |
| NP  | - | 0-290-64 | No Рass |
| W  | - | - | Withdrawal |
| AW  |  |  | Academic Withdrawal |
| AU  | - | - | Audit |

*Consider on the department meeting. Protocol № from « » 2013 year.*

**Policy of the academic behavior and ethics**

Be tolerant, respect foreign opinion. Objections formulate in a correct form. Plagiarism and other forms of dishonest work are unacceptable. The writing off are inadmissible during delivery of SRS, intermediate control and examination, copying of the solved tasks by other persons, passing an examination for other student. The student convicted of falsification of any information of a course, will receive a total assessment of "F".

*It is considered at faculty meeting*

*Protocol № \_\_ from « \_\_ » \_\_\_\_\_\_\_\_\_\_\_ year.*

The head chair of biotechnology Prof. B.К.Zayadan

Lecturer Prof. B.К.Zayadan

*\* Volume of syllabus 6-7 p.*

*\*\* The discipline of the module can contain 3-4 thematic blocks in which the training material is thematically united.*