

COURSE SYLLABUS AND COURSE REQUIREMENTS

ACADEMIC YEAR 2022/23 SEMESTER II.

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| Course title | Genetic Engineering and GMO |
| Course Code | MSM633AN-EA-00, MSM633AN-LA-01 |
| Hours/Week: le/pr/lab | 2+2 |
| Credits | 4 |
| Degree Programme | Biomedical Engineering MSc |
| Study Mode | Full time |
| Requirements | Fisnhing prerequisites |
| Teaching Period | 3. semester |
| Prerequisites | Cell and molecular biology, biochemistry |
| Department(s) | Dr. Krisztian Kvell |
| Course Director | |
| Teaching Staff | Dr. Krisztian Kvell, Dr. Krisztina Banfai, Dr. Kitti Garai |

COURSE DESCRIPTION

A short description of the course (max. 10 sentences).

Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description

The subject aims to provide students with basic information on how to perform nucleic acid manipulation in both cells and animals (yielding genetically-modified organisms or GMOs). The curriculum covers methods of nucleic acid manipulation as well as the use of recombinant viral vectors. Classic examples of monogenic hematological disease treatments are also discussed as examples describing methods of intervention, therapeutic goals and achievements. Potential drawback and pitfalls are also highlighted during the course. The course is practice-oriented to provide hands-on experience for students.

SYLLABUS

Neptun: Instruction/Subjects/Subject Details/Syllabus

1. GOALS AND OBJECTIVES

Goals, student learning outcome.

Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction

a) Knowledge

- Knows theory and practice in natural sciences and engineering sciences related to biomedical engineering.
- Knows methods and tools of mathematical modelling and computer simulation related to engineering and biological systems.
- Knows basic communication, leadership, organisation skills and ethics rules.

b) Ability

- Has the ability to utilise natural science and engineering science knowledge, then process, categorise, analyse and draw conclusion based on results gathered with healthcare system.
- Has the ability for modelling and describing the functional structure of the human body, physiological processes and regulations.
- Has the ability to enrich basic knowledge in the field of biomedical engineering.

c) Attitude

- Dedicated to security and safety as well as health improvement.
- Thrives to perform a job in a complex perspective applying systems integration and a process-oriented manner.
- Aims for new research, development and innovation goals, and to fulfil such goals.

2. COURSE CONTENT

Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content

TOPICS

| | |
|--------------------------------------|--|
| LECTURE | <ol style="list-style-type: none"> 1. Enzymes 1 Restriction endonucleases 2. Enzymes 2. Restriction cloning 3. Plasmids 4. Traditional PCR 5. PCR cloning 6. Real-time PCR 7. Digital PCR 8. Transfection methods 9. Viral gene delivery methods 10. RNA interference 11. CRISPR methodology 12. GM animal production 13. --- 14. --- 15. Exam |
| PRACTICE, LABORATORY PRACTICE | <ol style="list-style-type: none"> 1. Enzymes 1. Enzymatic digestion 2. Enzymes 2. Gel electrophoresis 3. Plasmids: Bacterial transformation 4. Traditional PCR 5. PCR cloning 6. Real-time PCR 7. Digital PCR 8. Transfection in prokaryotes and eukaryotes 9. Viral gene delivery methods 10. RNA interference 11. CRISPR methodology 12. GM animal production 13. --- 14. --- 15. Exam |

DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

LECTURE

| week | Topic | Compulsory reading; page number (from ... to ...) | Required tasks (assignments, tests, etc.) | Completion date, due date |
|------|-------------------------------------|---|---|---------------------------|
| 1. | Enzymes 1 Restriction endonucleases | Addgene Plasmids 101: A Desktop Resource (3rd Edition) Page 28-33+ lecture material will be uploaded to Teams | | 15. May 2023 |
| 2. | Enzymes 2. Restriction cloning | Addgene Plasmids 101: A Desktop Resource (3rd Edition) Chapter 2 Page 45-50+ lecture material will be uploaded to Teams | | 15. May 2023 |
| 3. | Plasmids | Addgene Plasmids 101: A Desktop Resource (3rd Edition) Chapter 1 Page 8-27+ lecture material will be uploaded to Teams | | 15. May 2023 |
| 4. | Traditional PCR | PCR handbook: 6-9 | | 15. May 2023 |

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|-----|-----------------------------|---|--|--------------|
| 5. | PCR cloning | Lecture material will be uploaded to Teams | | |
| 6. | Real-time PCR | ThermoFisher: Real-time PCR handbook 2-19 | | 15. May 2023 |
| 7. | Digital PCR | ThermoFisher: Real-time PCR handbook 62-68 | | 15. May 2023 |
| 8. | Transfection methods | Addgene Plasmids 101: A Desktop Resource (3rd Edition) Chapter 3 Page 75-87+ lecture material will be uploaded to Teams | | 15. May 2023 |
| 9. | Viral gene delivery methods | An introduction to genetic engineering, 3rd edition (DST Nicholl, 2008, ISBN: 978-0521615211) + lecture slides | | 15. May 2023 |
| 10. | RNA interference | An introduction to genetic engineering, 3rd edition (DST Nicholl, 2008, ISBN: 978-0521615211) + lecture slides | | 15. May 2023 |
| 11. | CRISPR methodology | An introduction to genetic engineering, 3rd edition (DST Nicholl, 2008, ISBN: 978-0521615211) + lecture slides | | 15. May 2023 |
| 12. | GM animal production | An introduction to genetic engineering, 3rd edition (DST Nicholl, 2008, ISBN: 978-0521615211) + lecture slides | | 15. May 2023 |
| 13. | --- | | | |
| 14. | --- | | | |
| 15. | Exam | | | |

PRACTICE, LABORATORY PRACTICE

| <i>week</i> | Topic | Compulsory reading; page number (from ... to ...) | Required tasks (assignments, tests, etc.) | Completion date, due date |
|-------------|--|--|--|----------------------------------|
| 1. | Enzymes 1. Enzymatic digestion | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 2. | Enzymes 2. Gel electrophoresis | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 3. | Plasmids: Bacterial transformation | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 4. | Traditional PCR | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 5. | PCR cloning | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 6. | Real-time PCR | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 7. | Digital PCR | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 8. | Transfection in prokaryotes and eukaryotes | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |

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|-----|-----------------------------|--|-----------|-------------|
| 9. | Viral gene delivery methods | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 10. | RNA interference | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 11. | CRISPR methodology | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 12. | GM animal production | Laboratory protocols will be uploaded to Teams | Lab notes | 9. May 2023 |
| 13. | --- | | | |
| 14. | --- | | | |
| 15. | Exam | | | |

3. ASSESSMENT AND EVALUATION

(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)

ATTENDANCE

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Method for monitoring attendance (e.g.: attendance sheet / online test/ register, etc.)

attendance sheet

ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

Course resulting in mid-term grade (PTE TVSz 40§(3))

Mid-term assessments, performance evaluation and their ratio in the final grade (The samples in the table to be deleted.)

Midterm evaluation is not planned.

Opportunity and procedure for re-takes (PTE TVSz 47§(4))

The specific regulations for improving grades and resitting tests must be read and applied according to the general Code of Studies and Examinations. E.g.: all tests and assessment tasks can be repeated/improved at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

Not applicable.

Grade calculation as a percentage

Not applicable.

Course-unit with final examination

Mid-term assessments, performance evaluation and their weighting as a pre-requisite for taking the final exam

Midterm evaluation is not planned.

Requirements for the end-of-semester signature

Signature requirement is having less than three missed weeks during the semester based on attendance sheets.

Re-takes for the end-of-semester signature (PTE TVSz 50§(2))

The specific regulations for grade betterment and re-take must be read and applied according to the general Code of Studies and Examinations. E.g.: all the tests and the records to be submitted can be repeated/improved each at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

Five exam options will be provided for students, including retake options.

Type of examination (written, oral): written test.

The exam is successful if the result is minimum **40** %.

Calculation of the grade (TVSz 47§ (3))

The performance at the exam accounts for **100** % in the calculation of the final grade.

Calculation of the final grade based on aggregate performance in percentage.

| Course grade | Performance in % |
|------------------|------------------|
| excellent (5) | 85 % ... |
| good (4) | 70 % ... 85 % |
| satisfactory (3) | 55 % ... 70 % |
| pass (2) | 40 % ... 55 % |
| fail (1) | below 40 % |

The lower limit given at each grade belongs to that grade.

4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

COMPULSORY READING AND AVAILABILITY

- Medical Biotechnology, editors: Pongracz J, Keen M, Elsevier (2009)
- Genetic Engineering, editors: PS Verma, VK Agarwall (2014)
- Genetic Engineering: Principles and Practice, editor: Mitra S (2015)

All are readily available through web / library.

RECOMMENDED LITERATURE AND AVAILABILITY

- An introduction to genetic engineering, 3rd edition, editor: DST Nicholl (2008)
- Addgene Plasmids 101
- ThermoFisher: Real-time PCR Handbook

All will be uploaded to Teams.