Taras Shevchenko National University of Kyiv

Institute of Geology

Department: General and Historical Geology

«APPROVED»
Deputy director on academic work

«N» 09 2020

WORK PROGRAMME OF THE DISCIPLINE
GEOLOGICAL RISKS AND HAZARDS
For students

Branch of knowledge: 10 – Natural sciences
Training direction (Speciality): 103 – Earth sciences
Educational level: Master
Educational program: Applied Geology
Type of discipline: Obligatory

Teaching mode: full-time studies
Academic year: 2020/2021
Semester: 2
Number of credits ECTS: 6
Language of teaching, learning and evaluation: English
Form of final control: Exam

Lecturer(s): Ivanik Olena Mykhalilivna, Doctor of science in geology, Professor, Department of General and Historical Geology
To be continued

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KYIV – 2020
Author(s): Ivanik Olena Mykhailivna, Doctor of science in geology, Professor, Department of General and Historical Geology

«Approved»

«4» 09 2020

Head of the Department of General and Historical Geology

(Ivanik O.M.)

Record of the Department meeting

№ 1, «4» September 2020

Approved by Scientific-Methodical Commission of the Institute of Geology

Record of the meeting № 1, «14» September 2020

Head of Scientific-Methodical Commission (Demidov V.K.)

«14» 09, 2020
Taras Shevchenko National University of Kyiv

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Head of the Department of General and Historical Geology

_________________________ (Ivanik O.M.)

Record of the Department meeting

№ ___, «___» September __, 2020

Approved by Scientific-Methodical Commission of the Institute of Geology

Record of the meeting № ___, «___» 14, September __, 2020

Head of Scientific-Methodical Commission __________ (Demydov V.K.)

«___» ____, 2020
1. **Aim of the discipline** is the acquaintance with characteristics of natural hazard processes according to various structural, tectonic, landscape and climatic areas, classification features, modern methods and technologies of research these processes and assessing their impact on the infrastructures.

2. **Discipline requirements:** Students must have skills and knowledge in the field of developing of integrated geological and geophysical models using specialized software, and theoretical knowledge related to such subjects as "General Geology", "Structural Geology", "Geomorphology and Quaternary Geology", "GIS in Geology".

3. **Annotation of teaching discipline / reference:** The discipline discusses the natural hazardous processes of varying genesis and their occurrence within various structural and tectonic areas, classification of natural hazardous processes, modern approaches and methods of their study, analysis of their impact on the infrastructure, including risk assessment.

4. **Object (teaching purposes)** – introduction of students with:
   1) classification and main types of natural hazardous processes in various structural and tectonic areas;
   2) main methods of the field investigation of the natural hazardous processes;
   3) methods of laboratory simulation of the natural hazardous processes;
   4) functional ability of special software for modelling of natural hazards;
   5) interpretation of modelling results;
   6) main approaches to the assessment and mitigation of natural risks and elaboration of preventive measures;

5. **Learning results:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Learning results</th>
<th>Form/Methods of teaching and studing</th>
<th>Form / Methods of evaluation</th>
<th>Percentage in the final assessment of the discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Manifestation of geological hazardous processes in various structural and tectonic areas</td>
<td>lecture, self-tuition</td>
<td>written work</td>
<td>up to 9.0%</td>
</tr>
<tr>
<td>1.2</td>
<td>Classifications of natural hazards</td>
<td>lecture, self-tuition</td>
<td>written work</td>
<td>up to 9.0%</td>
</tr>
<tr>
<td>1.3</td>
<td>Methods of field investigation of the geological hazardous processes</td>
<td>lecture, self-tuition</td>
<td>written work</td>
<td>up to 9.0%</td>
</tr>
<tr>
<td>1.4</td>
<td>Methods of laboratory simulation of the natural hazardous processes</td>
<td>lecture, self-tuition</td>
<td>written work</td>
<td>up to 9.0%</td>
</tr>
<tr>
<td>1.5</td>
<td>Modeling methods of the natural hazardous processes</td>
<td>lecture, self-tuition</td>
<td>written work</td>
<td>up to 9.0%</td>
</tr>
<tr>
<td>1.6</td>
<td>Main approaches to the assessment and mitigation of natural risks and elaboration of preventive measures</td>
<td>practical assignments, self-tuition</td>
<td>written work</td>
<td>up to 9.0%</td>
</tr>
<tr>
<td>2.1</td>
<td>Classify the natural hazards according to classification categories and groups</td>
<td>lecture, self-tuition</td>
<td>written work</td>
<td>up to 9.0%</td>
</tr>
<tr>
<td>2.2</td>
<td>Develop the geological and geophysical models of natural hazardous processes</td>
<td>lecture, self-tuition</td>
<td>written work</td>
<td>up to 9.0%</td>
</tr>
<tr>
<td>2.3</td>
<td>Develop the mathematical models of natural hazardous processes</td>
<td>practical assignments, self-tuition</td>
<td>written work</td>
<td>up to 9.0%</td>
</tr>
<tr>
<td>2.4</td>
<td>Develop the algorithms for modeling the impact of natural hazards on the natural and man-made</td>
<td>practical assignments, self-tuition</td>
<td>written work</td>
<td>up to 10.0%</td>
</tr>
</tbody>
</table>
2.5 Assess the impact of natural hazards on the infrastructure objects

<table>
<thead>
<tr>
<th>systems</th>
<th>tuition</th>
</tr>
</thead>
<tbody>
<tr>
<td>lecture, self-tuition</td>
<td>written work</td>
</tr>
</tbody>
</table>

**Structure of the discipline:** lectures, practical works and seminars, and self-studying work of students

6. **Learning Outcomes and scheduled results of tuition:**

<table>
<thead>
<tr>
<th>Program results of the tuition</th>
<th>1.1</th>
<th>1.2</th>
<th>1.3</th>
<th>1.4</th>
<th>1.5</th>
<th>1.6</th>
<th>2.1</th>
<th>2.2</th>
<th>2.3</th>
<th>2.4</th>
<th>2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO 1. Analyze natural and man-made systems and structures of the upper part of the Earth’s crust and its sedimentary layer.</td>
<td>*</td>
<td></td>
<td></td>
<td>*</td>
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</tr>
<tr>
<td>PO 2. Apply your knowledge and skills for the identification and solving of challenging problems and undertaking informed decisions in the questions related to stratigraphy, structural geology, geological interpretation of geophysical data, and geological risks management.</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
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</tr>
<tr>
<td>PO 7. Know modern methods of research of the upper part of the Earth’s crust and sedimentary layer, their application in production and research activities.</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO 9. Develop and implement projects of land management, perform geologic planning, monitor regional development trends, design land management plans and programs.</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td></td>
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</tr>
<tr>
<td>PO 10. Tackle practical challenges in tectonics, stratigraphy and geohazards monitoring using principles and methods of structural geology, micropaleontology, geochemistry and geophysics.</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO 12. Plan and guide innovation research projects in tectonics, stratigraphy and geohazards analysis, draw conclusions after the implementation of a project.</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

7. **Scheme of grading forms:**

7.1. **Semester grading:**

1) Test on classification and main types of natural hazardous processes - 10 points (cross-border score of 6 points)
2) Test on the main principles and approaches of the natural hazards risk assessment - 10 points (passing grade is 6 points)
3) Grading for work at practical classes - 40 points (passing grade is 24 points)

Final examination in the form of the written test: maximum grade is 40 points, passing grade is 24 points.

Results of educational activity of students grading are based on 100 grading scale.
The final grade is based on the results as the sum for the module grades, practical classes grades and the results of the Exam.

<table>
<thead>
<tr>
<th>Semester grade</th>
<th>Exam</th>
<th>Final grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 1</td>
<td>Module 2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Practical classes</td>
<td>Practical classes</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

| Total          |      |             |
| Minimum        | 18   | 18          | 24 | 60 |
| Maximum        | 30   | 30          | 40 | 100 |

A student is not allowed to pass a Exam if he graded less than 20 points during two semesters.

7.2. Grading: Control is carried out according to the modular rating system and provides for: passing of 7 practical classes (where students must demonstrate the quality of the acquired knowledge and solve the tasks set using the methods outlined by the teacher); and passed 2 written tests. The final grading is carried out in the form of a written exam.

7.3. Scale of Exam

<table>
<thead>
<tr>
<th>National scale</th>
<th>100 points scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>excellent</td>
<td>90 – 100</td>
</tr>
<tr>
<td>good</td>
<td>75 – 89</td>
</tr>
<tr>
<td>satisfactorily</td>
<td>60 – 74</td>
</tr>
<tr>
<td>Failed</td>
<td>0 – 59</td>
</tr>
</tbody>
</table>
### 8. PLAN OF LECTURES AND PRACTICAL CLASSES

<table>
<thead>
<tr>
<th>No.</th>
<th>Theme</th>
<th>Lectures</th>
<th>Practical classes</th>
<th>Self-studying work</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Introduction.</strong>&lt;br&gt;<strong>Theme 1.</strong> Classifications of natural hazardous processes in various structural, tectonic, landscape and climatic zones.</td>
<td>20/2*</td>
<td>2</td>
<td>25/30*</td>
</tr>
<tr>
<td>2</td>
<td><strong>Theme 2.</strong> Main causes of hazardous processes and principles of their analysis</td>
<td>10/15*</td>
<td>10/15*</td>
<td>5/5</td>
</tr>
<tr>
<td>3</td>
<td><strong>Theme 3.</strong> Main principles and methods of assessing the impact of natural hazards on infrastructure</td>
<td>25/30*</td>
<td>25/30*</td>
<td>25/30*</td>
</tr>
<tr>
<td></td>
<td><strong>Test 1</strong></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Module 2.</strong> Main principles and approaches of the natural hazards risk assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>Theme 4.</strong> Development of geological, geophysical and mathematical models of natural hazardous processes.</td>
<td>10/14*</td>
<td>10/14*</td>
<td>10/14*</td>
</tr>
<tr>
<td>5</td>
<td><strong>Theme 5.</strong> Elaboration of the algorithms modeling the impact of natural hazards on the natural systems and man-made structures</td>
<td>20/22*</td>
<td>20/22*</td>
<td>20/22*</td>
</tr>
<tr>
<td>6</td>
<td><strong>Theme 6.</strong> Main principles and approaches of the natural hazards risk assessment</td>
<td>10/16*</td>
<td>10/16*</td>
<td>10/16*</td>
</tr>
<tr>
<td>7</td>
<td><strong>Theme 7.</strong> Designing preventive and corrective measures for mitigation of natural hazards</td>
<td>20/31*</td>
<td>20/31*</td>
<td>20/31*</td>
</tr>
<tr>
<td></td>
<td><strong>Test 2</strong></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Exam</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>42/4*</td>
<td>14</td>
<td>120/158*</td>
</tr>
</tbody>
</table>

* on the Individual Education Plan

**Total - 180 hours:**
- Lectures – 42/4* hours,
- Practical classes – 14 hours
- Consultations – 4 hours
- Self-work – 120/158* hours

*Themes for self-studying work:*
1. Seismic hazards.
2. Effects of Tsunami and Linkages to other Natural Hazards.
3. Perception of and Adjustment to the Volcanic Hazards.
4. Human Interaction with flooding.
5. Assessment of Landslide Hazards
7. Coastal Hazards.
8. Climate change and Natural Hazards.
References:

General:
15. Ivanik O., Kaliukh I., Trofymchuk O., Farenyuk G and Shekhunova S. Practical measures for landslide risk mitigation in the Ukrainian Carpathians // Extended abstract: First EAGE Workshop on Assessment of Landslide and Debris Flows Hazards in the Carpathians, 2019, DOI: 10.3997/2214-4609.2019021656
16. Ivanik O., Shevchuk V., Yanchenko V., Kravchenko D., Pikul S. and Mazko A. Geomorphological and geological causes of landslide processes within the Kronsien structural and facial zone (Ukrainian Carpathians) // Extended abstract: 18th International Conference on Geoinformatics - Theoretical and Applied Aspects, 2019, DOI: 10.3997/2214-4609.201902117

Additional: