Taras Shevchenko National University of Kyiv

Institute of Geology

Department: General and Historical Geology

«APPROVED»
Deputy director on academic work

«14» 09 2020

WORK PROGRAMME OF THE DISCIPLINE

Tectonic Analysis in Geomorphology
For students

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

Teaching mode full-time studies
Academic year 2021/2022
Semester 3
Number of credits ECTS 6
Language of teaching, learning, and evaluation English
Form of final control Exam

Lecturer(s): Ivanik Olena Mykhailivna, Doctor of science in geology, Professor, Department of General and Historical Geology, Kravchenko Dmytro Volodymyrovych, PhD in Geology, Associate 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» 09 2020

Approved by Scientific-Methodical Commission of the Institute of Geology
Record of the meeting № 1 «14» 09 2020

Head of Scientific-Methodical Commission (Demydov V.K.)
«14» 09 2020
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«Approved»
«___» ___________ 2020

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_______________________(Ivanik O.M.)

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№ __, «___» ___________ 2020

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Record of the meeting №___, «___» ___________, 2020

Head of Scientific-Methodical Commission __________ (Demydov V.K.)
«___» _____, 2020
1. **Aim of the discipline** is to familiarize students with the main principles and methods of tectonic analyses in geomorphology, interplay between tectonic and surface processes that shape the landscape in regions of active deformation and at time scales, innovative applications of new techniques for determining the ages of landscape features, for assessing the mechanisms and rates of geomorphic processes, and for defining rates of crustal movement.

2. **Discipline requirements:**

Students must have skills and knowledge related to structural Geology, Geomorphology, Quaternary Geology and GIS analysis, they have to be familiar with basic geomorphological and structural concepts and terms.

3. **Annotation of teaching discipline / reference:**

Modern tectonic geomorphology is an exceptionally integrative discipline that utilizes techniques and data derived from studies of geomorphology, seismology, geochronology, structure, geodesy, stratigraphy, meteorology and Quaternary science. Tectonic analysis in geomorphology is the study of the interplay between tectonic and surface processes that shape the landscape in regions of active deformation and at time scales ranging from days to millions of years. The consideration is given to recent advances in the quantification of both rates and the physical basis of tectonic and surface processes. This discipline reviews the fundamentals of the subject, including the nature of faulting and folding, the creation and use geomorphic markers for tracing deformation, chronological techniques that are used to date events and quantify rates, geodetic techniques for defining recent deformation, and paleoseismologic approaches to calibrate past deformation. Tectonic geomorphology focuses on the current understanding of the dynamic interplay between surface processes and active tectonics. As it ranges from the timescales of individual earthquakes to the growth and decay of mountain belts, this course provides a timely synthesis of modern research for students and for practicing geologists.

4. **Object (teaching purposes) – introduction of students with:**

1) main types of geomorphic processes;
2) main methods of tectonic geomorphology;
3) geomorphology of folded terrain
4) geomorphology of fractured terrain;
5) methods of quantitative tectonic geomorphology;
6) geomorphic markers;
7) quantitative definition of tectonic landforms;
8) specialized software for modeling tectonic and geomorphic processes and structures.
9) Interpretation of modelling results.

5. **Learning results:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Learning results</th>
<th>Form/Methods of teaching and studying</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>Physics of geomorphic processes</td>
<td>lecture, practical class</td>
<td>Paperwork</td>
<td>up to 5%</td>
</tr>
<tr>
<td>1.2</td>
<td>Methods of dating geomorphic features</td>
<td>lecture, practical class</td>
<td>Paperwork</td>
<td>up to 5%</td>
</tr>
<tr>
<td>1.3</td>
<td>Geomorphology of folded terrain: bedrock attitude and landforms</td>
<td>practical class</td>
<td>Paperwork</td>
<td>up to 5%</td>
</tr>
<tr>
<td>1.4</td>
<td>Geomorphology of fractured terrain: jointing, faulting and landforms</td>
<td>lecture, practical class</td>
<td>Paperwork</td>
<td>up to 5%</td>
</tr>
<tr>
<td>1.5</td>
<td>Principles and Methods of Quantitative Tectonic Geomorphology</td>
<td>practical class</td>
<td>Paperwork</td>
<td>up to 5%</td>
</tr>
<tr>
<td>1.6</td>
<td>Geomorphic markers: landscape features, that can be used to track deformation</td>
<td>lecture, practical class</td>
<td>Paperwork</td>
<td>up to 5%</td>
</tr>
<tr>
<td>1.7</td>
<td>Tectonic deformation during the</td>
<td>practical class, self-study</td>
<td>Paperwork</td>
<td>up to 10%</td>
</tr>
<tr>
<td>Quaternary period</td>
<td>Create structural-morphometric models</td>
<td>practical class, self-study</td>
<td>Paperwork</td>
<td>up to 10%</td>
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<tr>
<td>-------------------</td>
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</tr>
<tr>
<td>2.2 Define amounts of tectonic deformations</td>
<td>practical class, self-study</td>
<td>Paperwork</td>
<td>up to 10%</td>
<td></td>
</tr>
<tr>
<td>2.3 Do the quantitative definition and analyses of tectonic landforms based on map and/or field observation</td>
<td>practical class, self-study</td>
<td>Paperwork</td>
<td>up to 10%</td>
<td></td>
</tr>
<tr>
<td>2.4 Develop the basic geomorphological models for solving set task</td>
<td>practical class, self-study</td>
<td>Paperwork</td>
<td>up to 10%</td>
<td></td>
</tr>
<tr>
<td>2.5 Use specialized software for modeling tectonic processes and structures</td>
<td>practical class, self-study</td>
<td>Paperwork</td>
<td>up to 10%</td>
<td></td>
</tr>
<tr>
<td>3.1 Be able to organize research and development team for the effective solution of the task</td>
<td>practical class</td>
<td>--/-</td>
<td>up to 5%</td>
<td></td>
</tr>
<tr>
<td>4.1 Understanding personal / personal responsibility for simulation results and recommendations</td>
<td>--/-</td>
<td>--/-</td>
<td>up to 5%</td>
<td></td>
</tr>
</tbody>
</table>

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

### 6. Learning Outcomes vs scheduled results of tuition:

<table>
<thead>
<tr>
<th>Learning Outcome</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>1.7</th>
<th>2.1</th>
<th>2.2</th>
<th>2.3</th>
<th>2.4</th>
<th>2.5</th>
<th>3.1</th>
<th>4.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PO 1.</strong> Analyze natural and man-made systems and structures of the upper part of the Earth’s crust and its sedimentary layer</td>
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<tr>
<td><strong>PO 2.</strong> 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>
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</tr>
<tr>
<td><strong>PO 6.</strong> Assess geological risks, including their environmental impact, predict the evolution of hazardous geological processes in the context of natural systems and man-made infrastructure, provide expert conclusions for the geological exploration and production licensing and certification of natural reserves</td>
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<td>*</td>
</tr>
<tr>
<td><strong>PO 7.</strong> 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>
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</tr>
<tr>
<td><strong>PO 9.</strong> Develop and implement projects of land management, perform geologic planning, monitor regional development trends, design land management plans and programs</td>
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<td>*</td>
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</tr>
</tbody>
</table>
7. Scheme of grading forms:

7.1. Grading forms

1. Semester grading:
   1) Test on Methods of dating geomorphic features - 10 points (cross-border score of 6 points)
   2) Test on Principles and Methods of quantitative tectonic geomorphology - 10 points (passing grade is 6 points)
   3) Grading for work at practical classes - 40 points (passing grade is 24 points)

2. 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>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>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Maximum</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

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 5 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>№</th>
<th>Theme</th>
<th>Total hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lectures</td>
</tr>
<tr>
<td>1</td>
<td>Introduction. <strong>Theme 1.</strong> Introduction to tectonic geomorphology Principles and Methods of tectonic geomorphology</td>
<td>10/1*</td>
</tr>
<tr>
<td>2</td>
<td><strong>Theme 2.</strong> Geomorphic markers. Establishing timing in the landscape: dating methods</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>Theme 3.</strong> Stress, faults, and folds. Geomorphology of folded terrain.</td>
<td>8/1*</td>
</tr>
</tbody>
</table>
Test 1

Module 2. STRUCTURAL DEFORMATIONS AND LANDSCAPE RESPONSES

<table>
<thead>
<tr>
<th>Theme 4. Geomorphology of fractured terrain: jointing, faulting and landforms</th>
<th>4/2*</th>
<th>10/15*</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Theme 5. Holocene deformation and landscape responses</th>
<th>10/1*</th>
<th>20/25*</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Theme 6. Tectonic geomorphology at late Cenozoic time scales. Deformation and geomorphology at intermediate time scales</th>
<th>12/4*</th>
<th>20/25*</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Theme 7. Numerical modeling of landscape evolution</th>
<th>4/2*</th>
<th>20/25*</th>
</tr>
</thead>
</table>

Test 2

Exam

Total | 28/3* | 28/14* | 120/161*

* - on the Individual Education Plan

Total - 180 hours:

Lectures – 28/3* hours,
Practical classes – 28/14* hours
Consultations – 4/2* hours
Self-work – 120/161* hours

Themes* for self-studying work:

1. Short-term deformation: geodesy.
2. The creation and use of geomorphic markers for tracing deformation.
5. Rates of erosion and uplift.
6. Development of structural-morphometric models

References:

General:

Additional:
5. Ivanik O., Shevchuk V., Tustanovska L., Yanchenko V. &Kravchenko D. Paleogeography and neotectonics of Kaniv dislocations (Ukrainian Shield, Ukraine) in the Neogene-Quaternary period, Historical Biology, 2019; DOI: 10.1080/08912963.2019.1665039.