Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Кафедра програмного забезпечення комп'ютерних систем

ANALYTICS IN PRODUCT IT

Syllabus

Details of the educational component

Level of higher education	***Second (Master)***
Branch of knowledge	*F Information Technologies*
Specialty	*F2 Software Engineering*
Educational program	*Software Engineering of Multimedia Systems and Smart Technologies*
Status of the educational component	*Normative*
Form of education	*Full-time*
A year of training	*1st year, Autumn semester*
The scope of the educational component	*Lectures: 30 hours, practical sessions: 30 hours, self-study: 60 hours.*
Semester control / control measures	*Test, intermediate test, calendar control*
Schedule of classes	*According to the schedule for the autumn semester of the current academic year (rozklad.kpi.ua)*
Language of instructions	*English*
Information about head of the course / teachers	*D.Sc., Prof. Yevgeniya Sulema, sulema@pzks.fpm.kpi.ua*
Course location	Google classroom. Access is given to registered students.

Program of educational component

1. Description of the educational component, its purpose, subject of study and learning outcomes

*The **purpose** of studying the discipline "Analytics in Product IT" is to develop students' ability to independently develop software that implements the latest multimedia user interfaces and 3D visualization tools.*

*The **subject** of the discipline "Analytics in Product IT" is the hardware and software of processes of representation, transformation, and reproduction of multimedia information.*

*Studying the discipline "Analytics in Product IT" allows students to develop the **General Competencies** (GC) and **Professional Competencies** (PC) necessary for solving practical problems of professional activity related to the development of modern multimedia user interfaces and the development of 3D visualization tools:*

GC01 – Ability to abstract thinking, analysis, and synthesis.

GC03 – Ability to conduct research at the appropriate level.

GC05 – Ability to generate new ideas (creativity).

PC02 – Ability to develop and implement scientific and/or applied projects in the field of software engineering.

PC06 – Ability to effectively manage financial, human, technical, and other project resources in the field of software engineering.

PC08 – Ability to develop and coordinate processes, stages, and iterations of the software lifecycle based on the application of modern software development models, methods, and technologies.

PC14 – Ability to analyze and compare business models of digital products based on data and performance metrics.

PC17 – Ability to apply software engineering methodologies in practice.

***Program Learning Outcomes** (PLO) of the discipline "Analytics in Product IT":*

PLO04 – Identify information needs and classify data for software design;

PLO23 – Be able to evaluate the effectiveness of IT product business models based on product metrics and analytical research results.

PLO28 – Be able to analyze the temporal dynamics of indicators using chain coefficients and draw reasonable conclusions regarding product development trends.

PLO29 – Be able to apply RFM and cohort analysis to estimate user retention and the lifecycle of a software product.

2. Pre-requisites and post-requisites of the educational component (place in the structural and logical scheme of training according to the relevant educational program)

Successful study of the discipline "Analytics in Product IT" is preceded by the study of disciplines "Probability Theory", "Programming", "Components of Software Engineering" of the curriculum for training bachelors in specialty Software Engineering.

Theoretical knowledge and practical skills obtained during the mastery of the discipline "Analytics in Product IT" can be used during the preparation of the master's thesis.

3. Content of the academic discipline

The discipline "Analytics in Product IT" involves the study of the following topics:

Topic 1. Fundamentals of Product Analytics

Topic 2. Mathematical Foundations of Product Analytics

Topic 3. Product Metrics and Behavioral Analytics

Topic 4. Experimental Analytics

Topic 5. Modeling and Forecasting

Topic 6. Business Analytics of Digital Products

Test

4. Educational materials and resources

Basic literature:

1. *Learning materials for the discipline "Analytics in Product IT". Used for mastering theoretical knowledge and practical skills in the discipline. Materials are located in Google Classroom. Access is provided to registered students.*

Additional literature:

2. *Training course "Analytics in Product IT" by Genesis company. Used for mastering practical skills in the discipline. Materials are provided upon request.*

Educational content

5. Methods of mastering the educational component

No.	Type of training session	Description of the training session
	Topic 1. Fundamentals of Product Analytics	
1	*Lecture 1. Introduction to Product IT and Product Analytics*	*Features of product IT companies. Product Management and Product Analytics. Data-Driven approach. The role of an analyst in a product team. Typical tasks of product analytics. Self-study assignment: item 6, No. 1.*
2	*Lecture 2. Data in Product IT*	*Data sources. Event-based analytics. Structure of analytical data. ETL and Data Pipeline. Data Warehouse and Data Lake. Self-study assignment: item 6, No. 1.*
3	*Practical Session 1. Descriptive Statistics of Product Data*	*Content: mean, median, mode, variance, standard deviation. Example of typical task: for a data set on user activity, determine the main statistical characteristics, detect anomalous values, build distribution histograms. Self-study assignment: item 6, No. 2.*
	Topic 2. Mathematical Foundations of Product Analytics	
4	*Lecture 3. Descriptive Statistics in Product Analysis*	*Data types. Central tendencies. Data variation. Visualization of statistical characteristics. Anomaly detection. Self-study assignment: item 6, No. 1.*
5	*Practical Session 2. Analysis of Data Distributions*	*Content: normal distribution, exponential distribution, quantiles, percentiles. Example of typical task: For the indicators "session time", "number of views", "revenue per user", determine the type of distribution and its characteristics. Self-study assignment: item 6, No. 2.*
6	*Lecture 4. Probability Theory in Product Analytics*	*Random events. Conditional probability. Independence of events. Bayes' formula. Probabilistic models of user behavior. Self-study assignment: item 6, No. 1.*
7	*Practical Session 3. Conversion Analysis as a Probabilistic Process*	*Content: classical probability, conditional probability, Bayes' rule. Example of typical task: calculate the probability of a product purchase by a user, including after viewing an ad, and the probability of purchase for different user segments. Self-study assignment: item 6, No. 2.*
8	*Lecture 5. Statistical Estimation and Hypothesis Testing*	*Samples and general population. Confidence intervals. Statistical hypotheses. p-value. Statistical significance. Self-study assignment: item 6, No. 1.*
9	*Practical Session 4. Confidence Intervals for Product Metrics*	*Content: sample mean, confidence interval, estimation error.*

		Example of typical task: estimate the mean value for the conversion indicator, build a 95% confidence interval, interpret the result. *Self-study assignment: item 6, No. 2.*
Topic 3. Product Metrics and Behavioral Analytics		
10	*Lecture 6. Main Product Metrics*	*Product KPIs. North Star Metric. OMTM. DAU, WAU, MAU. Stickiness.* *Self-study assignment: item 6, No. 1.*
11	*Practical Session 5. Statistical Hypothesis Testing*	*Content: null and alternative hypotheses, p-value, t-test.* *Example of typical task: check whether the conversion indicator changed after changing the page design.* *Self-study assignment: item 6, No. 2.*
12	*Lecture 7. User Behavior Analysis*	*Customer Journey. User Flow. Event Analytics. Analysis of user paths. Behavioral Analytics.* *Self-study assignment: item 6, No. 1.*
13	*Practical Session 6. Correlation Analysis*	*Content: Pearson coefficient, Spearman coefficient.* *Example of typical task: investigate the relationship between session duration, number of purchases, and number of viewed pages.* *Self-study assignment: item 6, No. 2.*
14	*Lecture 8. Analysis of Conversions and Product Funnels*	*Funnel Analytics. Conversion. Drop-off Analysis. Funnel optimization. Visualization of conversion paths.* *Self-study assignment: item 6, No. 1.*
15	*Practical Session 7. User Segmentation by Clustering Method*	*Content: Euclidean distance, centroids, cluster analysis.* *Example of typical task: perform user segmentation using the K-Means method.* *Self-study assignment: item 6, No. 2.*
16	*Lecture 9. Cohort Analysis and User Retention*	*Cohorts. Retention Rate. Churn Rate. Lifetime Analysis. Practical use of cohorts.* *Self-study assignment: item 6, No. 1.*
17	*Practical Session 8. Cohort Analysis*	*Content: matrices, relative values, statistical estimates.* *Example of typical task: build a cohort table and determine the Retention Rate.* *Self-study assignment: item 6, No. 2.*
Topic 4. Experimental Analytics		
18	*Lecture 10. A/B Testing and Experiments*	*Hypotheses in product development. Planning experiments. Control and test groups. Evaluation of results.* *Self-study assignment: item 6, No. 1.*
19	*Practical Session 9. Analysis of A/B Testing Results*	*Content: hypothesis testing, χ^2 criterion, statistical significance.* *Example of typical task: compare two versions of the interface and provide recommendations for product development.* *Self-study assignment: item 6, No. 2.*

Topic 5. Modeling and Forecasting		
20	*Lecture 11. Correlation Analysis and Regression Models*	*Correlation. Causality and correlation. Linear regression. Multifactor regression. Interpretation of models.* *Self-study assignment: item 6, No. 1.*
21	*Practical Session 10. Linear Regression for Product Indicator Forecasting*	*Content: linear function, method of least squares, coefficient of determination.* *Example of typical task: build a model for forecasting revenue depending on the number of active users.* *Self-study assignment: item 6, No. 2.*
22	*Lecture 12. Time Series Analysis in Product IT*	*Time series. Trend. Seasonality. Moving averages. Forecasting product indicators.* *Self-study assignment: item 6, No. 1.*
23	*Practical Session 11. Time Series Analysis*	*Content: trend, moving average, smoothing.* *Example of typical task: analyze DAU dynamics over 6 months and identify trends.* *Self-study assignment: item 6, No. 2.*
24	*Lecture 13. Machine Learning in Product Analytics*	*Classification. Clustering. Churn prediction. Recommender systems.* *Self-study assignment: item 6, No. 1.*
25	*Practical Session 12. Time Series Forecasting*	*Content: linear trend, exponential smoothing.* *Example of typical task: build a MAU forecast for the next quarter.* *Self-study assignment: item 6, No. 2.*
Topic 6. Business Analytics of Digital Products		
26	*Lecture 14. Analytics of Monetization and Business Efficiency*	*Revenue Analytics. ARPU. LTV. CAC. Unit Economics.* *Self-study assignment: item 6, No. 1.*
27	*Practical Session 13. Multifactor Regression*	*Content: multiple regression, matrix calculations.* *Example of typical task: build a model Revenue = f(DAU, Marketing Spend, Session Duration).* *Self-study assignment: item 6, No. 2.*
28	*Lecture 15. Modern Trends in Product Analytics*	*Real-Time Analytics. Product Intelligence. Generative AI for analytics. AI Agents in product teams. Digital twins of users and products. The future of Product Analytics.* *Self-study assignment: item 6, No. 1.*
29	*Practical Session 14. User Churn Forecasting*	*Content: logistic regression, probabilistic classification.* *Example of typical task: create a Churn Rate forecasting model.* *Self-study assignment: item 6, No. 2.*
30	*Practical Session 15. Concluding Session*	*Test.* *Self-study assignment: item 6, No. 3.*

6. Student's self-training

The discipline "Analytics in Product IT" involves independent preparation for classroom sessions on theoretical and practical topics.

No.	*The topic assigned for self-training*	*Number of hours*	*Literature*
1	*Preparation for Lectures 1–15*	*15*	*1*
2	*Preparation for Practical Sessions 1-14*	*30*	*2*
3	*Preparation for Practical Session 15*	*15*	*1; 2*

Policy and control

7. Policy of academic educational component

- *Compliance with the academic integrity policy.*
- *Attendance at practical classes is mandatory.*
- *Rules of conduct in classes: activity, respect for those present, turning off phones.*
- *Rules for awarding bonus points: points are awarded for a creative approach and activity during the semester (maximum number of points is 5 points).*

8. Rating system for evaluating learning outcomes

During the semester, students complete 14 practical assignments. The maximum number of points for each assignment is 5 points. Points are awarded for the quality of assignment execution.

Criteria for evaluating the quality of execution:
5 points – the assignment is completed correctly, in full;
3-4 points – the assignment is completed correctly, but has drawbacks;
1-2 points – the assignment is completed, but contains minor errors;
0 points – the assignment is not completed, or contains significant errors.
In case of a creative approach and activity based on the results of the semester, 5 bonus points can be awarded.

Maximum number of points for practical work:

5 points × 14 assignments + 5 bonus points = 70 points.

The assignment for the Intermediate Test consists of 6 questions. The answer to each question is evaluated from 0-5 points.

Criteria for evaluating answers to control work questions:

5 points – the answer is correct, complete, well-argued;

4 points – the answer is correct, detailed, but not very well argued;

3 points – in general, the answer is correct, but has drawbacks;

2 points – there are minor errors in the answer;

1 point – there are significant errors in the answer;

0 points – there is no answer or the answer is false.

Maximum number of points for the Intermediate Test:

5 points × 6 questions = 30 points.

The rating scale for the discipline is equal to:

R = RC = 70 points for practical work + 30 points for Intermediate Test = 100 points.

Calendar control: carried out twice a semester as a monitoring of the current state of compliance with the syllabus requirements.

On the first attestation (8th week), a student receives "passed" if their current rating is at least 12 points (50% of the maximum number of points a student can receive before the first attestation).

On the second attestation (14th week), a student receives "passed" if their current rating is at least 20 points (50% of the maximum number of points a student can receive before the second attestation).

Semester control: Final Test.

Conditions of admission to semester control:

With a semester rating (rC) of at least 60 points and the completion of all computer practicum works, the student receives a credit "automatically" according to the table (Table of correspondence of rating points to grades on the university scale). Otherwise, they must write a credit control work. A necessary condition for admission to the credit control work is the completion and defense of the computer practicum. If a student does not agree with the "automatic" grade, they can try to improve their grade by writing a credit control work, while their points obtained during the semester are preserved, and the best of the two grades obtained by the student is assigned ("soft" evaluation system).

Table of correspondence of rating points to grades on the university scale:

Scores	*Rating*
100-95	Excellent
94-85	Very Good
84-75	Good
74-65	Satisfactory
64-60	Fair
Less than 60	Unsatisfactory
Admission conditions not met	Not allowed

The syllabus prepared by DSc, Prof. Yevgeniya Sulema.

Approved by the PZKS department (protocol No 15 dated 15.04.2026).

Approved by the Methodical Commission of the Faculty of Software Systems and Applied Mathematics (protocol No 11 dated 22.05.2026).