

Ministry of Education and Science of Ukraine
Ivano-Frankivsk National Technical University of Oil and Gas
Institute of Information Technologies
the name of the institute of the graduation department



APPROVED

Head of IT institute

(name of the institute)

(signature) (First Name Surname)

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Syllabus

Backend development for IoT interfaces

(name of academic discipline)

Educational level master

(name of educational level)

Branch of knowledge 17 - Electronics, automation and electronic communications

(code and name of field of knowledge)

Specialty 175 - Information measurement technologies

(code and name of specialty)

Specialization

(name of specialization, if available)

Educational program "Information technologies for sustainable energy engineering"

(name of EP)

Discipline status optional

mandatory/optional

Language of teaching English

2023

Developer(s):

Associate professor of the Computer systems and
networks department, Ph.D.,
bohdan.pashkovskyi@nung.edu.ua

_____ Bohdan PASHKOVSKYI

Approved at the meeting of the Computer systems and networks department

Protocol No. _____, dated "____" _____ 20____.

Head of the Computer systems and networks department _____ Stepan MELNYCHUK

Approved:

Head of graduation department

_____ Viktoriia BANDURA

(Department of Software Engineering)

Guarantor of EP "Information technologies for sustainable
energy engineering"

_____ Ihor LIUTAK

1 GENERAL INFORMATION ABOUT THE EDUCATIONAL DISCIPLINE

The purpose and tasks of the discipline	<p><i>The module "Backend development for IoT interfaces" aims to teach applicants how to build REST backend applications using ASP .NET Core to create, read, update and delete IoT data within relational (MS SQL with Entity Framework Core) and non-relations (MongoDB, CosmosDb, Redis) databases. By the end of the module, students will have the skills needed to create, configure, deploy, test and scale REST applications.</i></p> <p><i>The aims of the "Backend development for IoT interfaces" module are to:</i></p> <ul style="list-style-type: none"> ● <i>Develop an understanding of the client server communication principle.</i> ● <i>Develop practical skills in building REST API using ASP .NET Core.</i> ● <i>Improve knowledge of relational and non-relational databases.</i> <p><i>Develop critical thinking skills.</i></p> <p><i>Overall, the module aims to provide students with the skills and knowledge needed to effectively create various applications.</i></p>
Link to place the discipline on the educational platform	<p>https://dn.nung.edu.ua/course/view.php?id=2343</p>
Prerequisites for studying the discipline / prerequisites	<p>-</p>
Post-requisites	<p><i>Computer simulation and design of experiment</i></p> <p><i>Design and development of information systems for energy industry control and monitoring</i></p>
Learning outcomes	<p><i>Practical skills:</i></p> <p><i>Students will acquire and develop practical skills such that they are able to:</i></p> <p><i>C2. solve complex tasks and problems of ICT, information and measurement technology, standardisation in quality assessment.</i></p> <p><i>C4. apply a comprehensive approach to solving experimental tasks in sustainable energy engineering using information and measurement equipment and application software.</i></p> <p><i>C5. develop software, hardware and metrological support of computerised information and measurement systems for sustainable energy engineering.</i></p> <p><i>Transferrable skills</i></p> <p><i>Students will acquire and develop transferable skills such that they are able to:</i></p>

	<i>D4. use information and communication technologies.</i>
Final control, form	<i>Credit</i>
List of social, "soft" skills (soft skills)	<p><i>The discipline "Backend development for IoT interfaces" can contribute to the development of various soft-skills, including:</i></p> <p><i>Practical Skills: Students will have gained practical skills in Software development, Database architecture, writing unit and integration tests, using source control systems.</i></p> <p><i>Technical knowledge: Students will have developed a strong understanding of the principles and methods of Object Oriented Programming, Object Oriented Design, SOLID principles. They will have knowledge of HTTP codes, methods and client-server architecture.</i></p> <p><i>Critical thinking skills: Students will have developed critical thinking skills, particularly in relation to software development. They will be able to evaluate the quality and maintainability of code.</i></p>

2 EDUCATIONAL DISCIPLINE POLICY

1) regarding attendance at classes and behaviour at them

The attendance of classes and the behaviour of students during classes are regulated by the current regulation "On the organisation of the educational process of IFNTUOG", the Code of Ethics of IFNTUOG, as well as the orders of the Rector of IFNTUOG regarding changes in the organisation of the educational process.

During lectures, the use of mobile phones, laptops and tablets is allowed for viewing presentation and text components of lecture materials. During laboratory classes, it is allowed to use phones and tablets for viewing presentation materials, as well as own laptops for performing laboratory work and demonstrating the results of work during the defence.

Attendance does not have a direct impact on the scoring system, however, in case of systematic absences from classes and non-fulfillment of the prescribed assessed activities (testing, laboratory works, course paper), the teacher reserves the right to report this case to the directorate of the institute in writing.

In the case of conducting classes using e-learning tools, access to the video meetings is carried out exclusively from the corporate email account for the purpose of identifying the student of higher education. If the defence of laboratory work is conducted using e-learning tools, the student must turn on the video connection during the defence of the work report.

2) regarding compliance with the principles of academic integrity

Adherence to the principles of academic integrity during classes is regulated by the current regulation "On academic integrity of employees and students of higher education of IFNTUOG" and the Code of Ethics of IFNTUOG.

During the laboratory work, it is allowed to use fragments of the source code of the program from open sources (forums, code generators based on artificial intelligence, etc.). The source code of the program is not the object of the plagiarism check, although the originality and non-triviality of the solution may positively affect the evaluation.

3) regarding evaluation

The evaluation policy is regulated by the regulation "On the organisation of the educational process at IFNTUOG" and the regulation "On the organisation of current, semester control and attestation of students of higher education with the use of e-learning technologies."

In order to be admitted to the semester control, at the time of completion of the classroom study (before the beginning of the examination session), the student must complete all the laboratory works and pass all the test controls listed in this syllabus. If this requirement is not met, the student will not be admitted to the final examination.

Component evaluations of laboratory work may include an input test control, and must also include an evaluation for the report and for the defence of the laboratory work. The grade for the report is no more than 50% of the total maximum grade for the laboratory work and is a mandatory condition for the laboratory work to be counted as completed.

4) regarding deadlines and rescheduling

The deadlines for the performance of the evaluated activities provided for in the process of studying the discipline are regulated by the schedule of the educational process of the IFNTUOG for the current academic year and are determined by the deadlines for the completion of classroom training. At the end of classroom training (before the beginning of the examination session), the student must complete all laboratory tests and pass all test controls provided for in this work program. If this requirement is not met, the student will not be admitted to the final examination.

To complete and redo the final control, the student must complete the laboratory tests and pass the test control, obtaining the minimum total score, which is regulated by the current regulatory documentation of the IFNTUOG.

5) regarding the recognition of the results of training in non-formal education (if such an opportunity exists)

Non-formal learning outcomes can be recognized and re-credited as part of assessed activities, PROVISIONS about the procedure for recognizing the results obtained in non-formal and

informal education at IFNTUOG
<https://docs.google.com/document/d/1ugtRgE4cDqvK41-NzMm4lce7r1rvVF2qy8ZGcmt9dI/edit> in case of presentation of a certificate of successful completion of the course (with the specified grade) and in case the topics of the online course, training, course correspond to the educational elements of the discipline. Examples of courses whose elements can be recognized and counted as graded activities:
<https://www.edx.org/learn/data-analysis>

Unified information

6) regarding contesting the results of control measures

Applicants of higher education have the right to appeal the evaluation of the discipline obtained during control measures. The appeal is carried out in accordance with the Regulation on appeals by applicants of higher education on issues related to the educational process, approved by the order of the rector of the university No. 43 of 24.02.2020. You can familiarise yourself with the document by link https://griml.com/L3VUV .	
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7) regarding conflict situations

Communication between the participants of the educational process (teachers, students) takes place on the basis of partnership relations, mutual support, mutual respect, tolerance and respect for each person's personality, and is aimed at acquiring true knowledge. The resolution of conflict situations is carried out in accordance with the Regulation on the resolution of conflict situations in IFNTUOG, approved by the order of the rector of the university No. 44 dated February 24, 2020. You can familiarise yourself with the document by link https://griml.com/i42PI .	
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8) regarding the student surveys

After completing the course, the applicant is given the opportunity to take a survey regarding the quality of teaching the discipline by link https://nung.edu.ua/department/yakist-osviti/04-anketuvannya	
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3 PROGRAM AND STRUCTURE OF THE EDUCATIONAL DISCIPLINE

3.1 Scope of the academic discipline

Table 1 characterises the resource of hours for studying the discipline "Principles and methods of data analysis in energy industry" according to the current learning plan, the distribution by semesters and types of educational work.

Table 1 - Distribution of hours allocated to the study of the discipline

Name of indicators	Total	Distribution by semesters	
		Semester 1	Semester 2
Number of ECTS credits	10		10
Total amount of time, hours	150		150
Classroom classes, hours, including:	48		48
- lecture classes	18		18
– practical/seminar classes	-		-
- laboratory classes	30		30
Independent work, hours	102		102
Semester control form (examination, assessment, defence of KR, defence of KP)			

3.2. Lecture classes

Table 2 characterises the thematic plan of lectures of the discipline.

Table 2 – Thematic plan of lectures

Code	Names of modules (M), content modules (CM), topics (T) and their content	Number of hours	literature
CM1	Backend development for IoT interfaces	18	1, 2, 3
T1	Introduction to ASP .NET Core	2	
T2	Controllers	2	
T3	Routing	2	
T4	Configuration	2	
T5	Exceptions Handlings	2	
T6	Results API	2	
T7	Using Database and Entity Framework	2	
T8	Authentication and Authorization	2	
T9	CQRS and Mediatr	2	
	Total hours	18	

3.3. Practical (seminar) classes

Practical (seminar) classes are not provided.

3.4. Laboratory classes

Topics of laboratory classes (list of laboratory works) of the discipline are listed in Table 3.

Table 3 – Topics of laboratory classes

Code	Names of modules (M), content modules (3M), topics of laboratory classes	Number of hours	literature
CM1	Backend development for IoT interfaces	30	1, 2, 3
T1	Introduction to ASP .NET Core	2	
T2	Controllers	4	
T3	Routing	4	
T4	Configuration	4	
T5	Exceptions Handlings	4	
T6	Results API	4	
T7	Using Database and Entity Framework	4	
T8	Authentication and Authorization	2	
T9	CQRS and Mediatr	2	
	Total hours	30	

3.5. Tasks for self-learning work of the student

Types of independent work within this course are listed in Table 4.

Table 4 – Types of independent work

Names of types of independent work	Number of hours
Studying the material presented at the lectures	18
Preparation for laboratory classes and control measures	18
Preparation of laboratory reports	18
Studying material for independent study	48
Total hours	102

The list of material submitted for independent study is given in Table 4.

Table 5 - Material presented for independent study

Codes	Names of modules (M), content modules (CM), questions submitted for independent study	Number of hours	literature
CM1	Backend development for IoT interfaces	48	
T1	MongoDB	16	5
T2	CosmosDb	16	6
T3	Redis	16	7
	Total hours	48	

Control over the processing of topics assigned to independent study is included in the current assessment of the relevant content modules.

4. EDUCATIONAL AND METHODOLOGICAL PROVISION OF THE DISCIPLINE

4.1. Core literature

1. Adam Freeman (2022). Pro ASP.NET Core 6: Develop Cloud-Ready Web Applications Using MVC, Blazor, and Razor Pages 9th ed. Edition.
2. Andrew Troelsen, Phil Japikse (2022). Pro C# 10 with .NET 6: Foundational Principles and Practices in Programming 11st ed. Edition
3. ASP.NET documentation. <https://learn.microsoft.com/en-us/aspnet/core/?view=aspnetcore-7.0>

4.2. Optional literature

4. Sean Whitesell, Rob Richardson, Matthew D. Groves (2022) Pro Microservices in .NET 6: With Examples Using ASP.NET Core 6, MassTransit, and Kubernetes

4.3. Information resources on the Internet(if necessary)

5. <https://www.mongodb.com/docs/drivers/csharp/current/>
6. <https://learn.microsoft.com/en-us/azure/cosmos-db/introduction>
7. <https://redis.io/docs/>
8. VLE Course <https://dn.nung.edu.ua/course/view.php?id=1664>

5. FORMS AND METHODS OF TEACHING AND ASSESSMENT

Forms and methods of training and assessment within the scope of this course are listed in Table 5.

Table 5 – Provision of program learning outcomes in appropriate forms and methods

Cipher of the program learning result	Teaching methods (TM)	Forms and methods of assessment (MFI)
<p><i>PR01. Know and understand modern methods of scientific research, organisation and planning of an experiment, computerised methods of research and processing of measurement results.</i></p> <p><i>PR02. Know and understand the basic concepts of the theory of measurements, apply them in practice and in computer modelling of objects and phenomena.</i></p> <p><i>PR04. Be able to perform analysis of engineering</i></p>	<p>TM 1.1 - lecture</p> <p>TM 1.2 – story-explanation</p> <p>TM 2.1 - illustration</p> <p>TM 2.2 - demonstration</p> <p>TM 2.4 - computer and multimedia methods</p> <p>TM 5 - deductive</p> <p>TM 7 - analytical</p> <p>TM 8 - synthetic</p> <p>TM 15 - problem-searching</p> <p>TM 18 - methods of independent work at home</p>	<p><i>MFO 2</i> - credit</p> <p><i>MFO 5</i> - oral control</p> <p><i>MFO 7</i> - laboratory-practical control</p> <p><i>MFO 8</i> - test control</p>

<p><i>products, processes and systems according to established criteria, choose and apply the most suitable analytical, calculation and experimental methods for conducting research, interpret research results.</i></p> <p><i>PR05. Be able to formulate and solve tasks in the field of metrology related to the procedures of object observation, measurement, control, diagnosis and forecasting, taking into account the importance of social constraints (society, health and safety, environmental protection, economy, industry, etc.).</i></p> <p><i>PR08. To have modern methods and techniques of design and research, as well as analysis of the obtained results.</i></p> <p><i>PR13. Apply hardware and software tools of modern information technologies to solve problems in the field of metrology and information measuring technology.</i></p> <p><i>PR15. Be able to use computerised databases, "cloud" and Internet technologies, scientific databases and other relevant sources of information</i></p>		
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6. CONTROL METHODS AND SUMMATIVE ASSESSMENT STRUCTURE

The distribution of points that students of education can receive based on the results of each type of current and final controls, is provided in the table 6

Table 6 - Distribution of evaluation points

Types of controlled works	Maximum number of points
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Laboratory works (9 works for 5 points each). Assessment components of each laboratory work: Report on the performance of laboratory work: 3 points Entrance control: 1 point (2 questions of 0.5 points each) Defense: 1 points	45
Two test control (20 closed test questions, duration of test control — 20 minutes) each	55
Total points	100

To determine the degree of mastery of the educational material with its subsequent evaluation, the levels of educational achievements of higher education applicants, given in Table 7, are used.

Table 7 - Levels of educational achievements

Levels of educational achievements	Percentage of points for completing tasks	Criteria for evaluating educational achievements	
		Theoretical training	Practical training
		Graduate of higher education	
Distinctive	90...100	is fluent in educational material, expresses his opinions, draws reasoned conclusions, reviews the answers of other students, creatively performs individual and collective tasks; independently finds additional information and uses it to implement the tasks set before him; freely uses new information technologies to supplement his own knowledge	can reasonably choose a rational way of performing the task and evaluate the results of his own practical activity; performs tasks not provided for in the curriculum; freely uses knowledge to solve the tasks set before him
Good	75...89	is fluent in educational material, applies knowledge in practice; summarizes and systematizes educational information, but allows minor shortcomings in comparisons, formulation of conclusions, application of theoretical knowledge in practice	according to the sample, independently performs practical tasks provided by the program; has stable task performance skills
Satisfactory	60...74	knows the educational material superficially, fragmentarily, at the level of memorization reproduces a certain part of the educational material with elements of logical connections, knows the basic concepts of the educational material	has elementary, unstable task performance skills
Unsatisfactory	less than 60	has fragmentary knowledge (less than half) in an insignificant total amount of educational material; lack of formed skills and abilities; significant mistakes are made during the answer	plans and performs part of the task with the help of the teacher

The results of training in the discipline are evaluated on a 100-point scale (from 1 to 100) with conversion to a rating on a traditional scale ("excellent", "good", "satisfactory", "unsatisfactory" according to the scale shown in Table 8).

Table 8 - Grading scale: national and ECTS

National	University (in	ECTS	Definition of ECTS
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	points)		
Perfectly	90-100	A	Perfectly – excellent performance with only a small number of errors
Good	82-89	B	Very good – above average level with few errors
	75-81	C	Good - generally correct work with a certain number of gross errors
Satisfactorily	67-74	D	Satisfactorily - not bad, but with a significant number of shortcomings
	50-66	E	Sufficient – performance meets the minimum criteria
Fail	35-49	FX	Fail - you need to work before you can get a credit or pass an exam
	0-34	F	Fail - serious further work is needed

7. TEACHING TOOLS

To carry out laboratory work in the discipline " Backend development for IoT interfaces y", a workplace with a PC or laptop must be provided, on which an operating system is installed that supports the installation of .NET and modern browsers. Also Visual Studio Community Edition or Visual Studio Code is required. All specified software products are freely distributed and can be obtained from the links provided in the laboratory workshop and the e-learning course.