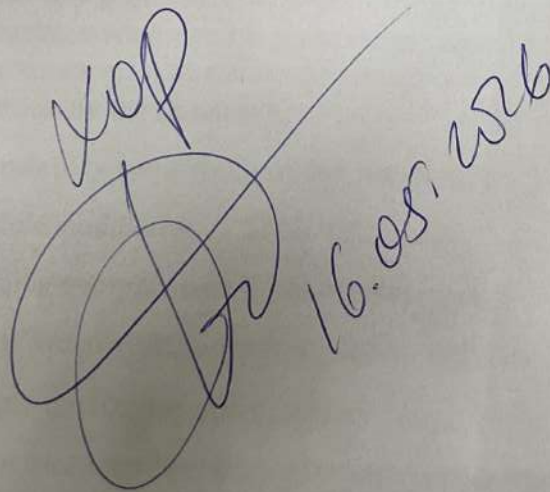


**Penza State University**  
Faculty of Computer Engineering  
Department of Computer Engineering

**EXPLANATORY NOTE**

for course design for the course  
«Logic and fundamentals of algorithmization in engineering problems»  
on the topic  
Complex program structure «Calculator Using Stacks»

Handwritten signature and date: 16.05.2026

Completed: Mohammed Maai  
student of group: 24VVIA1  
Accepted: Fedjunin R.N.

Penza 2026

✓

**Penza State University**  
Faculty of Computer Engineering  
Department of Computer Engineering

"APPROVE"

Head of the Department of Computer Engineering

  
M.A. Mitrokhin

«    »                      2026 y.

**EXERCISE**

for course design for the course

**Programming**

Student: Mohammed Maai                      Group: 24VVIa1

Project topic: *Development of a program using algorithms and data structures*

Initial data (technical requirements) for design

Application name: Calculator using stack

Task: The program must implement 10 basic arithmetic and logical operations. The program works with float and integer data. Data width: 16 and 32 bits. Data and operations must be processed using a stack. The number of stacks is specified and justified by the developer.

**Mandatory requirements for the program:**

1. Multimodularity.
2. Using complex data types of structures, files.
3. The video system operating mode is a text.
4. Input device: keyboard, mouse.
5. The user interface should be built on the basis of menus.
6. Availability of a screensaver.
7. MS Windows operating system.
8. C programming language.
9. Software development environment - Microsoft Visual Studio.

**Scope of work for the course**

**1. Calculation part**

Program development.

**2. Graphic part**

Data diagram, system resource diagram, system operation diagram, program hierarchical structure, program interaction diagram.

**3. Experimental part**

Debugging the program.

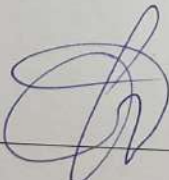
**Project completion time by section**

According to schedule

The assignment issuance date is \_\_\_\_\_.

Project defense date " " \_\_\_\_\_

Manager



Fedjunin R.N.

Received the task

" " \_\_\_\_\_

Student : Mohammed Maai

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### **Introduction**

The goal of this coursework is to develop a calculator program in the C programming language using stack data structures and the Shunting Yard algorithm.

The program performs arithmetic expression evaluation entered by the user in infix form. It converts the expression to postfix notation and then calculates the result.

This coursework helps develop practical skills in:

1. Working with stacks
2. Expression parsing
3. Algorithm implementation
4. Modular program design
5. Debugging and testing in C

### 1. Statement of the problem

It is required to develop a calculator program that:

1. Accepts a mathematical expression in infix notation from the user.
2. Supports operators:  $+$ ,  $-$ ,  $*$ ,  $/$ ,  $^$ .
3. Supports parentheses.
4. Converts infix expression into postfix notation using the Shunting Yard algorithm.
5. Evaluates the postfix expression using a second stack.
6. Displays the postfix expression.
7. Displays the calculated result.

The program must:

6. Use stack data structures.
7. Be modular.
8. Be implemented in C language.
9. Work in console mode.

### **Conclusion**

During this coursework, the following skills were improved:

- Implementation of stack data structures
- Understanding of the Shunting Yard algorithm
- Expression parsing techniques
- Modular program design in C
- Debugging and testing console applications

As a result, a functional calculator program was developed that correctly evaluates mathematical expressions.

The program can be improved by:

- Adding a graphical interface
- Supporting more operators
- Adding error handling
- Implementing prefix conversion

#### **List of sources used**

1. Wikipedia – Shunting Yard Algorithm. –  
URL: [https://en.wikipedia.org/wiki/Shunting\\_yard\\_algorithm](https://en.wikipedia.org/wiki/Shunting_yard_algorithm) (accessed date: 12.05.2026).
2. GeeksforGeeks – Expression Evaluation Using Stack. –  
URL: <https://www.geeksforgeeks.org/expression-evaluation-using-stack/> (accessed date: 12.05.2026).
3. Kernighan, B. W. The C Programming Language / B. W. Kernighan, D. M. Ritchie. – 2nd ed. – Englewood Cliffs, NJ : Prentice Hall, 1988. – 272 p.