

# Зразок контрольної роботи з курсу

"Методи теоретичного опису нерелятивістських і квантово-польових систем з порушеними симетріями"

КР №1

## Problem 1.

The Lagrangian of a massive relativistic particle is

$$\mathcal{L} = -m\sqrt{-\eta_{\mu\nu}\dot{x}^\mu\dot{x}^\nu}.$$

Find the Hamiltonian.

## Problem 2

Fix the overall sign in the action of massless scalar and vector fields

$$S_0 \sim \frac{1}{2} \int d^4x \partial_\mu \varphi \partial^\mu \varphi, \quad S_1 \sim \frac{1}{4} \int d^4x F_{\mu\nu} F^{\mu\nu}$$

for different signatures of the space-time metric:

- 1) for the 'mostly plus' signature  $\eta_{\mu\nu} = \text{diag}(-, +, +, +)$ ;
- 2) for the 'mostly minus' signature  $\eta_{\mu\nu} = \text{diag}(+, -, -, -)$ .