Homework 12

1. (30 points) For Scalar Field Cosmology, opbtain Cosmological Field Equations together with Klein - Gordon Equation expressed through the Planck - Mass.

2. (20 points) Consider slow - roll inflation approximation and express the equations discussed in Problem 1 through the slow - roll paremeters ϵ and η.

Obtain also expression for e - folding parameter N.

3. (40) Consider the example of massive potential

$$V(\phi) = \frac{m^2 \phi^2}{2}$$

and calculate

(a) e - folding parameter

(b) Huble function' s dependence on the scalar field

(c) time evolution of the scalar field,

(d) the time when the inflation ends

(e) time dependence of the scale parameter

(f) and rate of the expansion acceleration $\frac{\ddot{a}}{a}$.