PHY 167, Spring 2020, Final Exam practice

(5 points maximum for each problem, 25 points maximum for the whole. Write your name clearly. **Analytical results should be provided, otherwise the solution is incomplete.**)

1. Three charges Q each are put in the apices of an equilateral triangle with side L. Calculate the electric fields in the middle of each side of the triangle.

2. A doubly-charged Helium atom is accelerated by the voltage $V = 500$ V in the right-bound direction and then it enters the region with the electric field $E = 200$ V/cm directed to the left. By what distance l will the atom penetrate into the region of the field?

3. Voltage V is applied to the system of two capacitors C_1 and C_2 connected serially. What is the voltage and charge on each of the capacitors (Formulas)? Calculate numerical values for $V = 12$ V and $C_1 = 1$ μF and $C_2 = 2$ μF.

4. A loop has a form of a rectangle of sides a and b and it consists of N turns of wire. The resistance of the wire is R. Magnetic field B makes initially the angle θ with the plane of the loop. Then the magnetic field changes its direction to the opposite during the time Δt. What is the average EMF in the circuit? What is the average current? What is the charge Q that goes through the loop? What work W should be done to rotate the loop?

5. What is the smallest thickness d of a soap film (n=1.42) that gives a maximal reflection if illuminated by a green light (λ=700 nm)? (Use the interference condition for the light reflected from the top and bottom sides of the film, taking into account the possible $\lambda/2$ phase change upon reflection).