THE INTERNATIONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY - HCMC

MIDTERM EXAMINATION – CLASS

Student Name:_____ Student ID:_____

Date: April 2021

Duration: 90 minutes

SUBJECT: PHYSICS 3	
Chair of Department of Physics: Signature: Full name: Phan Bảo Ngọc	Lecturer: Phan Bảo Ngọc Signature: Full name:

INSTRUCTIONS: This is a closed book examination. Use of cell phones, laptops, dictionaries is not allowed.

1/ (20 pts) Three non-conducting spherical shells are fixed in place. Shell 1 has a uniform surface charge density $\sigma_1 = +5.0$ $\mu C/m^2$ on its outer surface and radius 6.0 cm; shell 2 has uniform charge density $\sigma_2 = +3.0$ $\mu C/m^2$ on its outer surface and radius 4.0 cm; shell 3 has uniform charge density $\sigma_3 = +2.0$ $\mu C/m^2$ on its outer surface and radius 2.0 cm. The center of shell 1 is at origin O. The centers of shell 2 and 3 are on the x axis, at 2 cm and 12 cm from origin O (Figure 1), respectively. In unit-vector notation, what is the net electric field at the origin O? ($k = 9.0\times10^9$ N.m^2/C^2; **Hint: Use the shell theorem**)

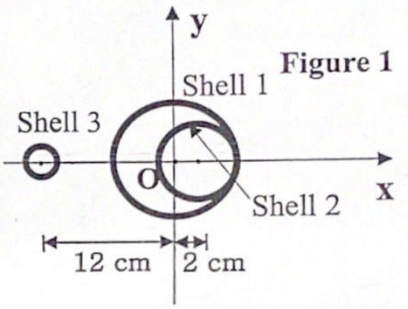

Figure 1

2/ (10 pts) A proton is at the origin and an electron is on the y axis at y = 0.5 mm. Find the electric dipole moment of these two particles in unit-vector notation.

3/ (10 pts) Figure 2 shows a uniform electric field of 4.0×10^5 N/C perpendicular to the left face of a large neutral vertical conducting plate. Find the surface charge density of the left (σ_L) and right (σ_R) surfaces of the plate. ($\varepsilon_0 = 8.85\times10^{-12}$ C^2/(N.m^2); **Hint:** Use Gauss' law to explain the distribution of negative and positive charges on the left and right surfaces, then calculate the charge density on each surface)

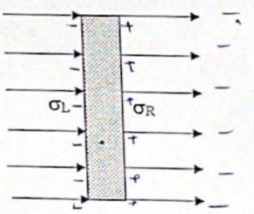

Figure 2

4/ (20 pts) Calculate the work done by an external force to bring **four** 2.0×10^{-9} C positive point charges from infinity and place them at the corners of a square of side 8 cm. ($U = \frac{kq_1q_2}{r}$)

5/ (20 pts) A 25-kΩ resistor and a capacitor are connected in series. A 12-V potential difference is suddenly applied across them. The potential difference across the capacitor rises to 4.0 V in 1.3 μs. Find the capacitance C. ($V = \varepsilon\left(1 - e^{-\frac{t}{RC}}\right)$)

6/ (20 pts) Determine the currents in Figure 3 if $\varepsilon_1 = 12$ V, $\varepsilon_2 = 6$ V, $\varepsilon_2 = 3$ V, $R_1 = 1\ \Omega$, $R_2 = 2\ \Omega$ and $R_3 = 3\ \Omega$.

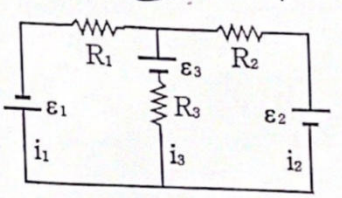

Figure 3

END OF QUESTION PAPER