

### PHYSICS BONUS HOMEWORK (25 points)

A nonuniform spherically symmetric distribution of charge has a charge density  $\rho(r)$  given as follows:

$$\rho(r) = \rho_0(1 - r/R) \quad \text{for } r \leq R$$

$$\rho(r) = 0 \quad \text{for } r > R$$

Where  $\rho_0 = 3Q/\pi R^3$  is a positive constant. (a) Show that the total charge contained in the charge distribution is  $Q$ . (b) Show that the electric field in the region  $r > R$  is identical to that produced by a point charge  $Q$  at  $r=0$ . (c) Obtain an expression for the electric field in the region  $r \leq R$ . (d) Graph the electric field magnitude  $E$  as a function of  $r$ . (e) Find the value of  $r$  at which the electric field is maximum, and find the value of that maximum field.

***The deadline for submission of the assignment is 30 April 2024 (Tuesday) at 11:30 am. Assignments submitted after this date and time will not be accepted. Those who share their homework will not be evaluated.***