



Electromagnetic Fields  
Course Code: ECE262  
Spring Semester  
Mid-term exam



BME Program  
Level 200  
Exam Date: 30-3-2019  
Allowed Time: 1 Hour

Open-Sheet  
Exam.

*Answer as many questions as you can. Assume any missed data. Full mark is 20.*

**Q.1)** A line charge of  $\rho_L = 2 \text{ nC/m}$  along the y-axis and a uniform surface charge density of  $0.5 \text{ nC/m}^2$  exists on the plane  $x = 4 \text{ m}$ . Find  $\vec{E}$  at the point P (1,2,3). [5 Marks]

**Q.2)** A charge Q is located at (-1,0,0) and a charge 2Q is located at (2,0,0). Find the point in space where  $E=0$ ? [5 Marks]

**Q.3)** A charge 2Q is located inside a conducting spherical shell with inner radius 3 cm, and outer radius 4 cm which carries a charge  $-Q$ . Determine and sketch the electric field everywhere versus 'r'. Sketch the electric field lines. [5 Marks]

**Q.4)** Given that  $\vec{D} = 0.2\rho^2\hat{a}_\rho \text{ C/m}^2$  within the cylinder  $\rho = 4$  and  $-5 \leq z \leq 5$ , find the volume charge density  $\rho_v$ . Verify divergence theorem for the volume enclosed by this cylinder. [5 Marks]

**Q.5)** Define *equi-potential surface*. Derive an expression for the electric potential of a circular ring of radius 'a' located in the x-y plane, at a point (0,0,z). Consider the uniform linear charge density of the ring to be ' $\rho_L$ '. Use the result to get the electric field at the same point. [5 Marks]

*My best wishes to all of you!*

*Assoc. Prof. Hossam El-Din Moustafa*