國立成功大學

110學年度碩士班招生考試試題

編　號：113

系　所：工程科學系

科　目：電磁學

日　期：0203

節　次：第 2 節

備　註：不可使用計算機

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※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Vector analysis provides a concise way to express the relations of quantities in the electromagnetic model. (25%)
   (1) What is the physical definition of the gradient of a scalar field? (10%)
   (2) Show that the space rate of increase of a scalar field of space coordinate V can be described by $dV = (\nabla V) \cdot dl$, where dl denotes the vector differential displacement in a chosen coordinate system. (15%)

2. Given a charged parallel-plate capacitor with an area A. Find the force on the conducting plates of the capacitor that are separated in air by a distance y. (25%)

3. Given a cylindrical bar magnet with a radius a and length h. Moreover, assume that the cylinder is uniformly magnetized and has axial magnetization $\mathbf{M} = \mathbf{a}_z M_0$. Find the magnetic flux density on the axis of the cylinder. (25%)

4. Consider a transmission line that is described by the following four parameters: R (resistance per unit length), L (inductance per unit length), G (conductance per unit length), and C (capacitance per unit length). (25%)
   (1) Describe the propagation constant of the transmission line in terms of R, L, G and C for sinusoidal excitation. (15%)
   (2) Describe the characteristic impedance of the transmission line in terms of R, L, G and C for sinusoidal excitation. (10%)