

國立成功大學

111學年度碩士班招生考試試題

編 號：168

系 所：電機工程學系

科 目：電子材料概論

日 期：0219

節 次：第 2 節

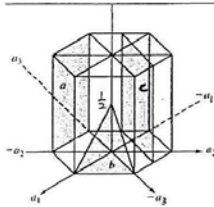
備 註：不可使用計算機

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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. Shortly explain the following terms of materials. (a) covalent bonding (b) ionic bonding (c) dislocation (d) eutectoid reaction (e) precipitation hardening (f) solid solution (g) ohmic contact (h) heterojunction (i) solid-state diffusion (j) face-center cubic. (40%)
2. Choose the proper analysis tools (from i-iv) to observe the micro-to-nano structures of materials or identify the properties of materials (a) The surface morphology of a thin film with  $\sim 1 \text{ nm}$ , (b) band gap, (c) crystal structure, (d) chemical bonding. (20%)  
(i) x-ray photoelectron spectroscopy (ii) photoluminescence spectroscopy (iii) X-ray diffraction (iv) scanning electron microscope.

3. Determine the miller indices of the hexagonal crystal planes a, b, and c. (20%)



4. The Hall measurement was used to measure a semiconductor. In this setup, a perpendicular magnetic field was applied to the electric field. The carrier concentration and mobility were found to  $1.2 \times 10^{23} \text{ cm}^{-3}$  and  $100 \text{ cm}^2 \text{ V}^{-1} \text{ S}^{-1}$ . Please calculate the resistivity of this material. (electron charge =  $1.6 \times 10^{-19} \text{ C}$ ) (10%)
5. Discuss the challenge and possible solution for the thermoelectric materials from the material science points of views. (Hints: start from the Wiedemann-Franz law:  $\frac{k}{\sigma T} = \text{constant}$ ) (10%)