

國立中正大學

113 學年度碩士班招生考試

試題

[第3節]

科目名稱	近代物理
系所組別	機械工程學系光機電整合工程

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

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科目名稱：近代物理

本科目共 1 頁 第 1 頁

系所組別：機械工程學系光機電整合工程

1. (30%) Explain the formulas and phenomena of total internal reflection, reflection, and interface reflection: Total internal reflection: (10%), Reflection: (10%), Interface reflection: (10%).
2. (10%) Explanation of the conditions for total internal reflection.
3. (10%) The ratio of the focal length of a camera lens to the size of the aperture diameter is called the f-number (also known as f-number or focal ratio). The focal length of the lens of a digital camera lens is fixed at 50 mm. When the f-number is set to 2, the correct exposure time for the best photo is 1/100 second. If the f-number is set to 4, the best exposure time. How many seconds should the time be ?
(A) $\frac{1}{25}$ (B) $\frac{1}{50}$ (C) $\frac{1}{100}$ (D) $\frac{1}{150}$
4. (10%) Use Bohr's theory to determine the magnetic moment of an electron moving on the n th orbit of a hydrogen atom. Show that the ratio of the magnetic moment to the angular momentum is constant for orbits.
5. (30%) In the spectrum of the sodium atom, the spectral lines D_1 and D_2 are due to transitions from the first two excited states $2P_{1/2}$ and $2P_{3/2}$ to the ground state $2S_{1/2}$, respectively.
 - (a) Draw an energy level diagram and indicate the Zeeman energy shifts if the atom is in a weak magnetic field. (10%)
 - (b) Indicate the allowed transitions between the Zeeman shifted energy levels between these two states. (10%)
 - (c) Express the Zeeman energy shifts of the D_1 lines in terms of fundamental constants. (10%)
6. (10%) A molecule consists of two elements A and B with a bond length L . The masses of A and B are m_a and m_b , respectively. Find the energy and angular velocity of the molecule when it is in its lowest rotational state.