1. 選擇題 (30%, 每題3分，請於答案卷上自繪如下之表格並將正確答案填入)

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(1) Find the value of $I$ and $V$ in the circuit shown below: (a) $I=2mA$, $V=0V$, (b) $I=2mA$, $V=5V$, (c) $I=0mA$, $V=5V$, (d) $I=0mA$, $V=0V$. (Assume that the diode is ideal.)

![Circuit Diagram]

(2) For an n-JFET, when $V_{GS}$ turns more negative, the breakdown voltage of $V_{DS}$ becomes: (a) no change, (b) greater, (c) smaller, (d) infinite.

(3) Which of the following statements is wrong for p-channel JFETs? (a) $V_{p}$ is a negative number in convention, (b) $V_{GD} > V_{p}$ for the pinch-off region, (c) $V_{GD} < V_{p}$ for the triode region, (d) the boundary between the pinch-off and triode regions is $V_{GD} = V_{p}$.

(4) Which of the following devices has 4 terminals? (a) PMOS, (b) Diode, (c) JFET, (d) NPN BJT.

(5) The two circuits shown below are equivalent. The $R_{DG}$ and the $V_{DG}$ should be: (a) 250 kΩ, 15V, (b) 250 kΩ, 6V, (c) 60 kΩ, 15V, (d) 60 kΩ, 6V.

![Circuit Diagrams]

(6) When trivalent (三個價電子) elements are used in doping, the resulting material is called ________ material and has an excess of ________.
(a) n-type, valence-band holes (b) n-type, conduction-band electrons (c) p-type, valence-band holes (d) p-type, conduction-band electrons (e) none of the above

(7) Determine the static resistance of a diode whose $V_{D}=0.8$ V and $I_{D}=4$ mA.
(a) 4 $\Omega$ (b) 80 $\Omega$ (c) 200 $\Omega$ (d) 1000 $\Omega$ (e) none of the above
8. In most cases, which two of the three BJT terminal currents are approximately equal in value?
(a) collector current and base current  (b) collector current and emitter current
(c) emitter current and base current  (d) all currents are approximately equal  (e) no two are ever approximately equal in value

9. Which transistor amplifier configuration is the most commonly used?
(a) common-emitter  (b) common-collector  (c) common-base  (d) none of them are used more often than the others.

10. In the circuit shown below, calculate the current flowing in R₁:
(a) 5.34 mA  (b) must know the value of R₂ to calculate the current  (c) 3.67 mA  (d) 2.45 mA.

![Circuit Diagram](image)

2. (14%) Consider the circuit shown below. Assume that both the cut-in voltage and forward-on voltage of the diode D are 0.7 V. (a) When \( V_s = 2V \), find \( V_o \) (7%), (b) When \( V_s = 1V \), find \( V_o \) (7%).

![Circuit Diagram](image)

3. (21%) The figure shown below is a JFET common source amplifier, which has \( V_f = 4V \) and \( I_{DSS} = 12mA \). Find the following operating quantities: (a) \( V_G \) (4%), (b) \( I_D \) (5%), (c) \( V_{GS} \) (4%), (d) \( V_D \) (4%), and (e) \( R_m \) (4%).

![Circuit Diagram](image)
4. For the circuit shown below. Let \( R_C = 1 \, \text{k}\Omega \), \( R_E = 3 \, \text{k}\Omega \) and \( I_E = 5 \, \text{mA} \). (20%)
   (a) Calculate \( V_{CE} \) to confirm active operation.
   (b) Find \( R_B \).
   (c) What will be the value of \( I_E \) if \( \beta \) decreases to 25.
   (d) What will be the value of \( I_E \) if \( \beta \) increases to 100.

5. For the circuit shown below, when \( I_C = I_{C\text{sat}} = 8 \, \text{mA} \), \( I_B = 125\% \) of \( I_{B\text{max}} \). (15%)
   Determine \( R_B \) and \( R_C \).

\[ \begin{align*}
   R_B & \quad \Rightarrow \quad R_C \\
   V_{BE} & = 0.7\text{V} \\
   V_{sat} & = 0.2\text{V} \\
   R_E & \quad \Rightarrow \quad 25\text{V}
\end{align*} \]

\[ \begin{align*}
   5 \, \text{V} \\
   0 \, \text{V}
\end{align*} \]