1) A reflex klystron operates under the following conditions, $V_0 = 500\text{v}$, $R_{sh} = 20\text{K Ohms}$, $f = 8\text{GHz}$, $d = 1\text{mm}$ is the spacing between repeller and cavity. The tube is oscillating at frequency at the peak of $n = 2$ mode (or $1\ 3/4$ mode). Assume that the transit time through the gap and beam loading can be neglected.

a) Find the value of the repeller voltage.

b) Find the direct current necessary to give a microwave gap voltage of $200\text{v}$.

c) Calculate the electronic efficiency. Consider $J_1(0.758) = 0.31$.

2) A reflex klystron operates at the peak of the $n = 1$ or $3/4$ mode. The DC power is $40\text{ mw}$ and the ration of $v_1$ over $V_0$ is $0.278$

a) Determine the efficiency of the reflex klystron.

b) Find the total output power in milli-wats.

c) If $20\%$ of the power delivered by the electron beam is dissipated in the cavity walls, find the power delivered to the load given that $J_1(0.655) = 0.283$.

3) Derive an expresion for the round trip transit time in the repeller region of a reflex klystron then determine the maximum difference between the transit times of any two electrons in the beam.

4) Derive an expression for the electronic addmittance of the reflex klystron. From it deduce the condition for oscillation.

5) Explain with appropriate diagrams the frequency tuning of the reflex klystron.

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