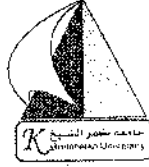


Kaferelsheikh University
Faculty of Engineering
Department of Electrical Engineering
Year: Forth
Subject: Microwave electronic engineering ECE4115
Name:



Date: 6/1/2019
Time allowed: 3 h
Full Mark: 90 degree
Final Exam: 2 page

Academic Number:

This exam measures ILOs no: a.3, a. 5,a.14 a.15 and a.20 b.6 and b.13 c.1, .c.5, and c.15 d.1

Question#1: (14Mark)

1-Explain the bunching process of a two-cavity klystron and derive the expression for bunching parameter with neat sketch. (8marks)

2-A four-cavity CW klystron amplifier has the following parameters: (6marks)

Beam voltage: $V_0 = 30$ kV, Beam current: $I_0 = 3$ A, Gap distance: $d = 1$ cm

Operating frequency: $f = 8$ GHz, Signal voltage: $V_i = 15$ V(rms), Beam coupling coefficient: $\{\beta_0 = \beta_i = 1$, dc electron charge density: $P_0 = 10^{-7}$ C/m³

- The dc electron velocity
- The dc electron phase constant
- The plasma frequency
- The reduced plasma frequency for $R = 0.4$
- The transit time across the input gap
- The modulated electron velocity leaving the input gap

Question #2: (16 Mark)

1- Explain the working principle of reflex klystron and derive expression of bunching parameter with neat sketch. (6 marks)

2- A reflex klystron operates at the peak of the $n = 1$ or $3/4$ mode. The dc power input is 40 mW and the ratio of V_i over V_0 is 0.278. : (6 marks)

- Determine the efficiency of the reflex klystron.
- Find the total output power in milliwatts.
- If 20% of the power delivered by the electron beam is dissipated in the cavity walls, 40 mW and the ratio of V_i over V_0 is 0.278.

3- Explain the Brillouin diagram for helix TWT. (4 marks)

Question #3: (16 Mark)

1- In an 0-type traveling-wave tube, the acceleration voltage (beam voltage) is 3000 V. The characteristic impedance is 10Ω . The operating frequency is 10 GHz and the beam current is 20 mA. Determine the propagation constants of the four modes of the traveling waves (4marks)

2-Draw a net sketch of TWT, explain major difference between it and klystron cavity and the explain its operation principle. (6 marks)

3- An X-band pulsed cylindrical magnetron has the following parameters: (6 marks)

Anode voltage: $V_0 = 32$ kV, Anode current: $I_0 = 84$ A, Magnetic flux density: $B_0 = 0.01$ Wb/m², Radius of cathode cylinder: $a = 6$ cm, Radius of vane edge to center: $b = 12$ cm

Best Wishes

الاسئلة في صفحاتين

Dr. noha abd al salam, Committee of Correctors and Testers

Compute:

- a. The cyclotron angular frequency
- b. The cutoff voltage for a fixed B_0
- c. The cutoff magnetic flux density for a fixed V_0

Question #4: (24 Mark)

1- Draw cross sectional view of cylindrical magnetron tube, then explain how bunching occur. Derive the expression for Hull cut-off voltage. (8marks)

2- An X-band pulsed conventional magnetron has the following parameters: (6marks)

Anode voltage: $V_0 = 22$ kV, Anode current: $I_0 = 28$ A, Operating frequency: $f = 10$ GHz

Resonator conductance: $G_r = 3 \times 10^{-4}$ Ω^{-1} , Loaded conductance: $G_l = 3 \times 10^{-5}$ Ω^{-1} , Vane capacitance: $C = 3$ pF, Duty cycle: $DC = 0.001$, Power loss: $P_{loss} = 200$ kW

Compute:

- a. The angular resonant frequency
- b. The unloaded quality factor Q_{un}
- c. The loaded quality factor Q_l
- d. The external quality factor Q_{ex} ,
- e. The circuit efficiency
- f. The electronic efficiency.

3- Explain the equivalent circuit of a resonator of a magnetron. (4 marks)

4- Explain the operation principle of linear Backward-wave crossed-field oscillator (BWCFO): (Carcinotron). (6 marks)

Question #5: (20 Mark)

1- Explain the construction and operation of tunnel diode. (7 marks)

2- What are the characteristics of IMPATT diode and its applications? What is the difference between it and schottkey, PIN diodes? (7 marks)

3- Sketch the structure of Read diode, and explain the operation principle. (6 marks)

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