APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Scheme for Valuation/Answer Key

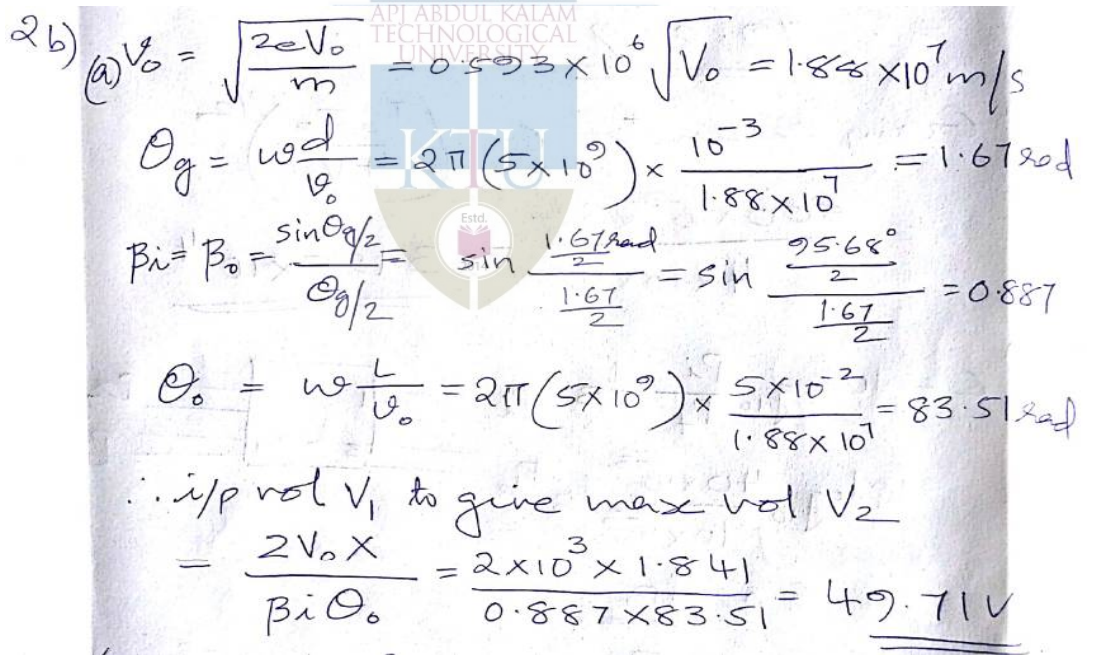
Scheme of evaluation (marks in brackets) and answers of problems/key

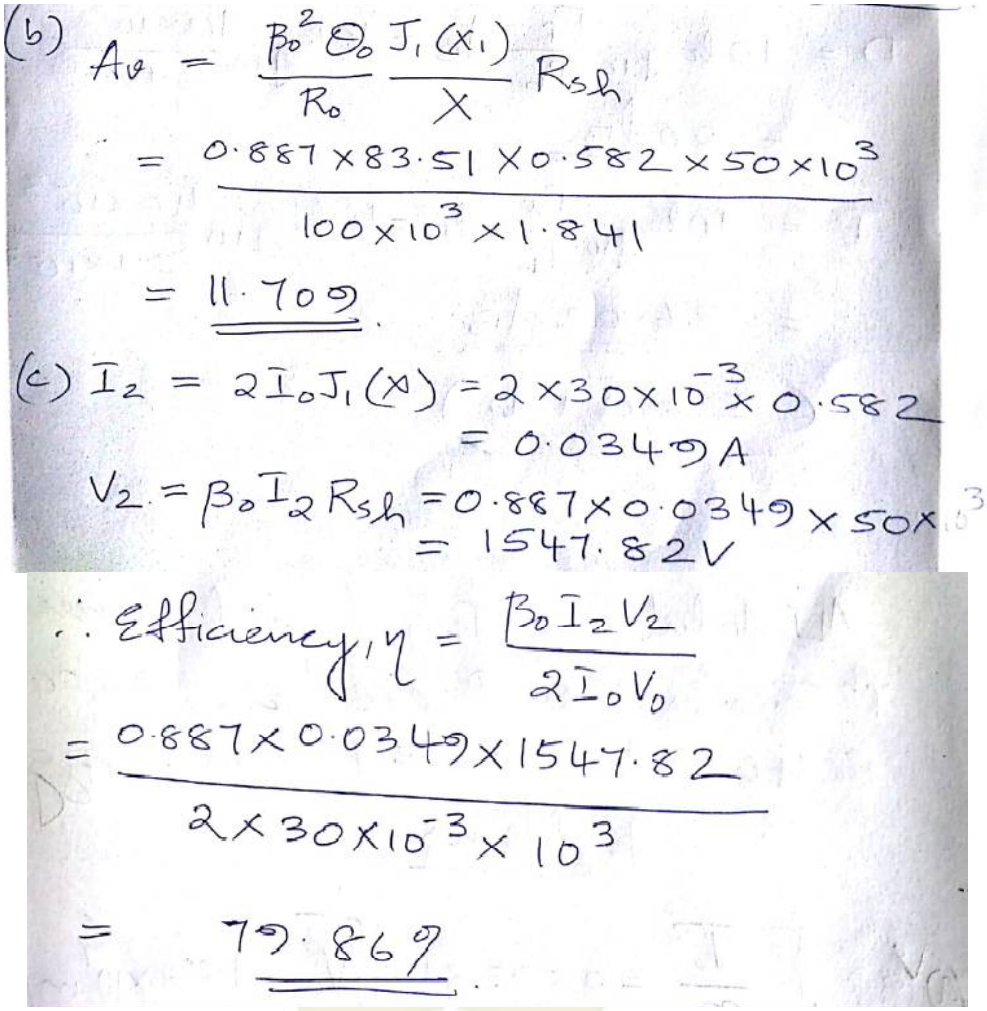
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

EC403, MICROWAVE & RADAR ENGINEERING

1. a. Explaining the limitations of conventional vacuum tubes at microwave frequencies – **5 Marks**
   b. Re-entrant cavity - equivalent circuit & its explanation - **4 Marks**
   Mathematical derivation – **6 Marks** (can give full marks if structural description is not given but derived completely)

2. a. Applegate diagram illustrating 1(3/4) mode, 2(3/4) mode etc. – **8 Marks** (can give full marks even if the figure is drawn with one mode)
   b. Use formula (for a-**2 Marks**; b-**2 Marks** & c-**3 marks** write the efficiency in% - if the formulas are written can give 50% marks)





(b) $A_v = \frac{\beta_0^2 \theta_0}{R_0} \frac{J_1(X_1)}{X} R_{sh}$

$= \frac{0.887 \times 83.51 \times 0.582 \times 50 \times 10^3}{100 \times 10^3 \times 1.841}$

$= 11.709$

(c) $I_2 = 2 I_0 J_1(X) = 2 \times 30 \times 10^{-3} \times 0.582$

$= 0.0349\ A$

$V_2 = \beta_0 I_2 R_{sh} = 0.887 \times 0.0349 \times 50 \times 10^3$

$= 1547.82\ V$

$\therefore$ Efficiency, $\eta = \frac{\beta_0 I_2 V_2}{2 I_0 V_0}$

$= \frac{0.887 \times 0.0349 \times 1547.82}{2 \times 30 \times 10^{-3} \times 10^3}$

$= 79.869$

3. a. Cavity resonators -**1 Mark**, Resonant frequency derivation: **4 Marks**
   b. Structure of 8 cavity magnetron – 3, explanation on cross field tube – **2**, explanation on bunching process - **5**

4. a. Types of slow wave structure - **5 Marks**
   b. Formula- **4 Marks**; final answer - **6 Marks**

$$\text{Gain Parameter, } C = \left(\frac{I_0 Z_0}{4V_0}\right)^{1/3}$$

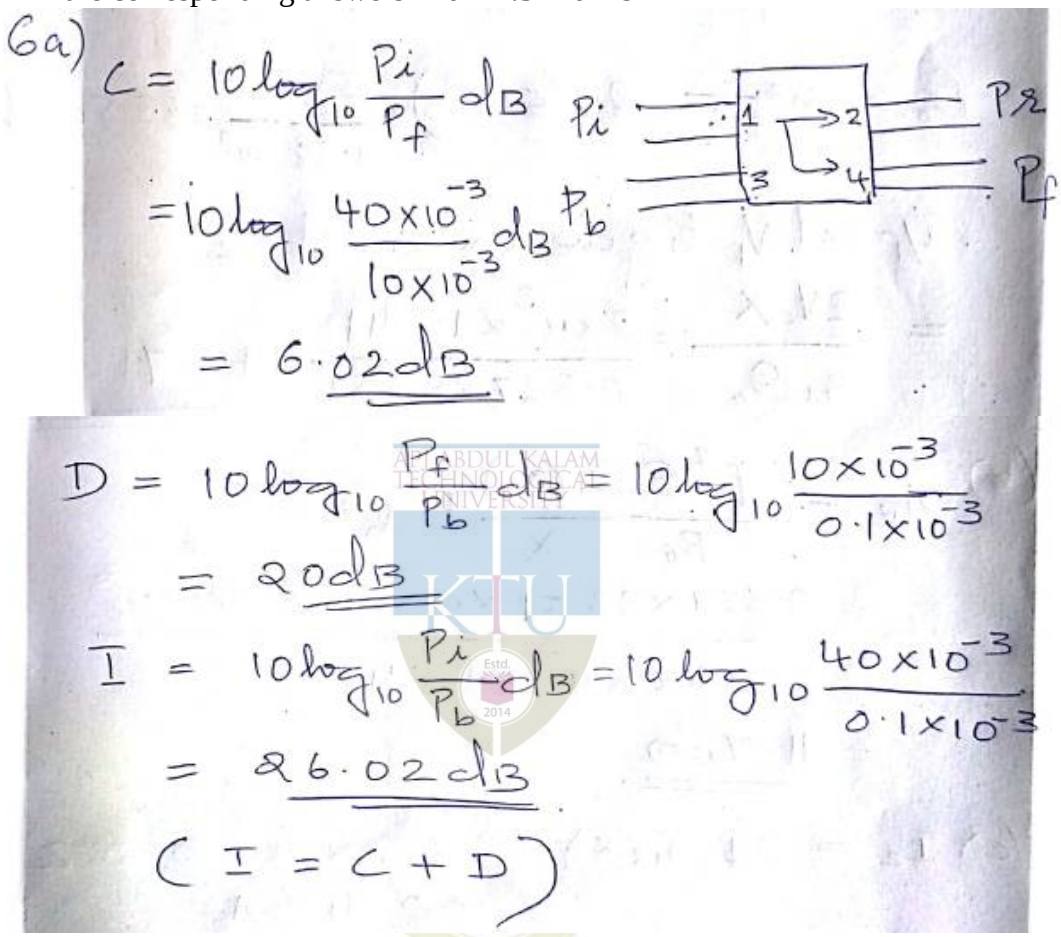
$$= \left(\frac{500 \times 10^{-3} \times 25}{4 \times 10 \times 10^3}\right)^{1/3}$$

$$= 0.0679$$

5. a. Draw 2- port network with the direction of incoming & outgoing waves – **2 marks,** based on the same give S-parameter of 2-port -**3 Marks**
   b. Different types of frequency meters & working principle - **2 Marks** & how measurement done with any type- **8 Marks** (can give full marks even if the different types of frequency meters are not written and measurement of frequency is only

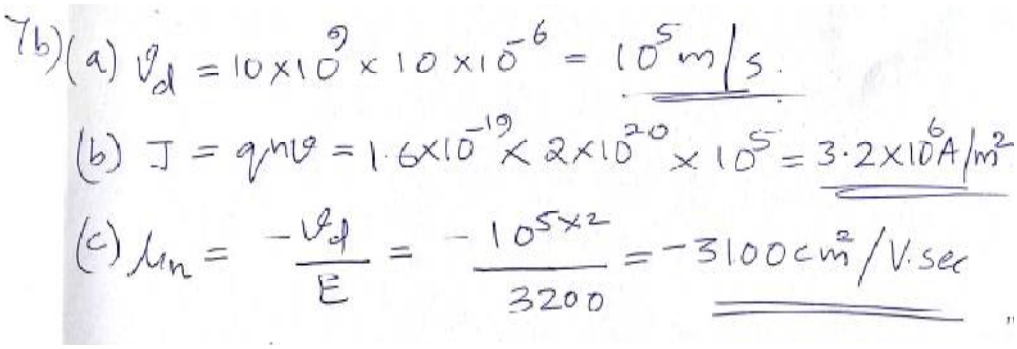
explained)

6. a. All parameters expression or relationship if written correctly - **2.5Marks**
   All the corresponding answers in dB-**2.5 Marks**



   b. How extended interaction is happening in TWT & how Energy transferred - **4 Marks** Derivation- **6 Marks** (can give full marks even if only derivation is written and theory is not explained)

7. a. **5 Marks** (can give full marks if students write comparison of any parameters microwave diodes)
   b. Equations: **3 Marks**, Answers: **4 Marks** (In case the student write concept or equations of drift velocity, current density and electron mobility, then full credit can be given)



c. Assumptions made in power frequency limitations - **4 Marks** & limitations of microwave transistor- **4 Marks**

8. a. Differences between Transistors &TED's – **5Marks**
   b. Series &Parallel loading with circuit -**7 Marks** (full credit may be given even if the student write the principle of tunnel diode)
   c. RWH theory – **4 Marks**; Derive condition for negative resistance -**4 Marks**

9. a. Different geometries - **2.5Marks** & figure of merit - **2.5Marks**
   b. Working of CW radar with non-zero IF –block diagram- **4 Marks;** Explanation - **3Marks.**
   c. (i) Draw the I-V characteristics curve and explain the various regions of tunnel diode (Full credit can be given if the student write about the working of tunnel diode with any related diagram) - **4 Marks**
   (ii) Negative resistance & how amplification occurs explain (full credit can be given even if the student write only about negative resistance effect) - **4 Marks**

****