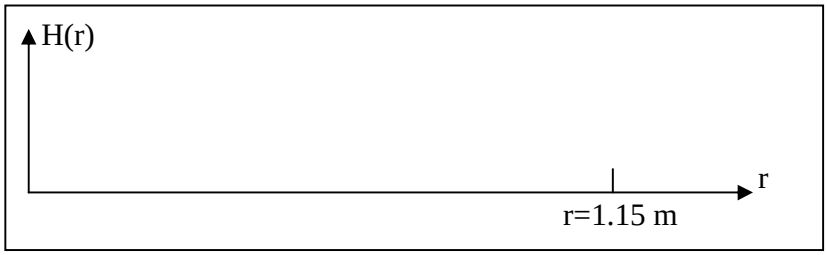
JUAS 2003 RF-Technology – EXAMINATION Name:

1 For a given pillbox cavity with a radius R = 1.15 meter and a height H=0.5 meter determine **(7P)**

1.1 the resonance frequency for the fundamental mode (TM_{010} type) (1P)

1.2 Indicate qualitatively below the electric field strength E(r) as a function of radius. It is proportional to which function? (1P)

1.3 Indicate qualitatively below the magnetic field strength H(r) as a function of radius. It is proportional to which function? (1P)



1.4 Which are the ONLY present E- and H- field components in the cavity for the mode mentioned above? (r,φ and z coordinates) (1P)

1.5 Calculate (general expression and numerical solution) the R/Q and the Q value assuming that the cavity is made from normal copper at room temperature. Neglect the transit time factor! (2P)

1.6 What is the decay time τ of cavity version 1. (1P)
(general expression using the Q -value and numerical result)

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2 Fill in all the missing fields in the tables below **(7P)**

2.1 (2P)

Voltage ratio	Power ratio	dB
3.1623		
	100	
		40

2.2 (2P)

dBm (50 Ohm)	RMS Voltage	milli Watt
0		
+30		
-60		
		100

2.3 (1P)

We have got part of the S-matrix of an ideal attenuator. Fill in the missing elements.
How many dB are written on this attenuator for its nominal attenuation?

$$[S]=\begin{bmatrix} 0 & 0.1 \\ \dots & \dots \end{bmatrix}$$

2.4 (2P)

Now we have an ideal amplifier with perfect input and output match (i.e. input and output impedance are both 50 Ohm) a gain of 40 dB and no reverse transmission.
(import: port 1, output: port 2)

$$[S]=\begin{bmatrix} \dots & \dots \\ \dots & \dots \end{bmatrix}$$

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3. The locus of inpedance of a parallel RLC resonant circuit (without additional transformers) **(6P)** is given in the complex w-plane (left) [w-plane = normalized z-plane, normalization to 50 Ohm].

- 3.1 Tranform this locus of impedance into the Smith Chart. (1P)
- 3.2 Mark the resonance frequency both in the w-plane and in the Smith Chart (select between f1, f2, f3). (1P)
- 3.3 Show (with a mark) the -3dB points (for unloaded Q) both in the w-plane and in the Smith Chart (select between f1, f2, f3). (1P)
- 3.4 Determine R and Q and subsequently L and C for this resonator. (2P)
- 3.5 What is R/Q for this resonator? (1P)

Smith Chart

w-plane