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~~SECOND~~ SEMESTER – I

M. Tech.[MOCE]

SUPPLYMENTARY EXAMINATION ~~FEB~~-2019

EC-551 ADVANCE ELECTROMAGNETIC THEORY

Time: 3 Hours **Max. Marks: 100**

Answer Any FIVE Questions

Assume suitable missing data, if any

1. Derive the expression of T_{mn}^{z} in a rectangular waveguide of dimension $a\ X\ b$. (20)

2. A partially filled waveguide is shown in Fig.1. Show that for TM to X mode fields $\frac{kx_1}{\epsilon_1} tankx_1 d = -\frac{kx_2}{\epsilon_2} tankx_2(a-d)$ where kx_1 and kx_2 are the wave number in x-direction of region 1 and 2 respectively. (20)

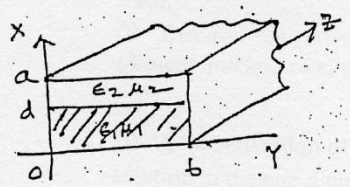

Fig.1.

3. Derive the expression of the quality factor of a circular cavity of radius a and height d. The cavity has been excited with TE_{mnp} mode. (20)

4. For a capacitive rectangular waveguide junction, show that the Z directed power flow at z=0 is given by $P = \sum_{m=1}^{\infty}\sum_{n=0}^{\infty} y_{mn}^{*}|E_{mn}|^2 \frac{ab}{\epsilon_n}$ (20)

5. Show that the resonant frequencies of the two dimensional (no x variation) resonator formed by conducting plates over x=0, x=a, y=0, y=b planes are the cut-off frequencies of the rectangular waveguides (20)

6. For a circular waveguide of radius a, show that the cut-off frequencies of TM_Z and TE_Z modes can be found out from $J_\rho' = 0\ for\ TE_z\ mode$

$$J(K_\rho a) = 0\ for\ TM_z\ mode$$ (20)

7. Show that (20)

(i) $(Z_0)_{mn}^{TM_x} = \frac{K^2-(m\pi/a)^2}{\omega\varepsilon k_x}$

$= \frac{K^2-(m\pi/a)^2}{\omega\varepsilon\beta}$ $f > f_0$

$= = \frac{K^2-(m\pi/a)^2}{-j\omega\varepsilon\alpha}$ $f < f_0$

(ii) $(Z_0)_{mn}^{TE_x} = \frac{\omega\mu k_z}{K^2-(m\pi/a)^2}$

$= \frac{\omega\mu\beta}{K^2-(m\pi/a)^2}$ $f > f_c$

$= \frac{-j\omega\mu\alpha}{K^2-(m\pi/a)^2}$ $f < f_c$