編號： 280　系所：電腦與通信工程研究所丁組　　科目：電磁波

本試題是否可以使用計算機： ☑可使用 ， ☐不可使用 （請命題老師勾選）

PROBLEM 1 (20 Points)

(a) Write down the complete Maxwell's equations in differential form.

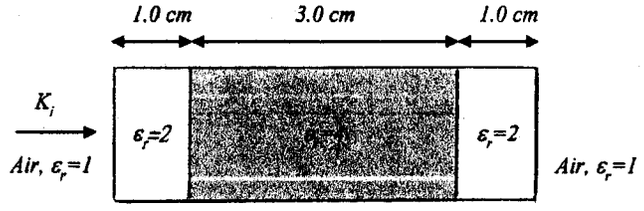
(b) Write down the boundary conditions for electric flux density, electric field intensity, magnetic flux density, and magnetic field intensity.

PROBLEM 2 (20 Points)

On a transmission line, the voltage wave is given by $V(l) = 120e^{0.0025l}\cos(10^8 t + 2l) + 60e^{-0.0025l}\cos(10^8 t - 2l)$, where l is the distance from the load. If $Z_L = 300\Omega$, find: (a) α, β, and v_p, (b) Z_0 and $I(l)$.

PROBLEM 3 (10 Points)

A three-layer structure is shown in the figure. The permeability of all three media is μ_0. If complete transmission is required for any thickness of the center medium, what is the lowest usable frequency?



PROBLEM 4 (10 Points)

The waveguide wavelength of a propagating mode along an air-filled parallel-plate waveguide at 15 GHz is found to be 2.5 cm. Find the cutoff frequency of this mode.

PROBLEM 5 (20 Points)

(1) The current distributions of infinitesimal ($L<<\lambda$) dipole antenna A and B are given as $I_A = 2I_0(L/2-|z|)/L$ and $I_B = I_0$, for $-(L/2) \le z \le (L/2)$. Find the ratio of the radiation resistance of these two antennas. (2) A linear array on the z axis, with five isotropic sources of equal amplitude and equal distance $d=\lambda/3$, such that the main beam is at $\theta=120^\circ$. Find the required progressive phase difference between the antenna elements.

(背面仍有題目,請繼續作答)

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PROBLEM 6 (20 Points)

A transmission line with characteristics impedance of 50Ω is terminated at a load of $100-j150\Omega$. Find (a) its reflection coefficient $|\Gamma|$ at the load, (b) the location of the first (average) voltage minimum away from the load, (c) the impedance $\lambda/8$ away from the load. If another load of impedance $j50$ is shunt to the line at a location $\lambda/8$ away from the original load, what is the VSWR (d) on the right, and (e) on the left of this load? What is (f) the final input impedance? (Note: you may use the Smith chart below, temporarily. But don't forget to write down important procedures and results on your answer sheet. Otherwise it will not be graded.).