Problem 1: (4 Points)

A standing wave with a VSWR = 2.2 in a lossless medium has a maximum field intensity E = 76 mV/m. Find: (a) minimum field intensity and (b) reflection coefficient.

Problem 2: (8 Points)

A TEM wave with electric field intensity $E_x = 10\cos(\pi \times 10^7 t - kz)$ μV/m is traveling in vacuum. Find: (a) the value of k, (b) the wavelength of this wave, (c) the direction of propagation, and (d) the expression of magnetic field intensity.

Problem 3: (18 Points)

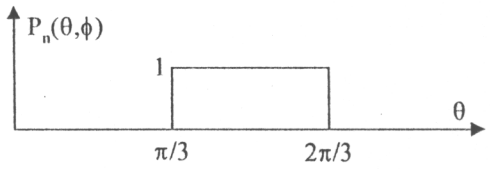
State in detail the phase velocity and group velocity. A 1-MHz plane wave traveling in a normally dispersive, lossless medium has a phase velocity at this frequency of 300 Mm/s. The phase velocity as a function of wavelength is given by $v = k\sqrt{\lambda}$ where k is a constant. Find the group velocity.

Problem 4: (10 Points)

Derive wave equation for electric field intensity in vacuum from Maxwell's equations, assuming the wave travels in y direction and the electric field in x direction.

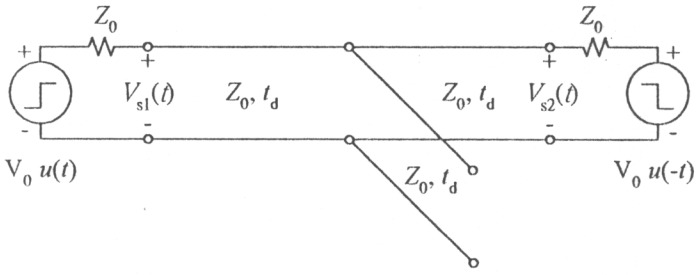
Problem 5: (20 Points)

An antenna has the radiation power intensity given by the following figure and is independent of ϕ. Find the beam solid angle, directivity and effective aperture for this antenna.



Problem 6: (20 Points)

For the circuit shown below, sketch the voltage $V_{s1}(t)$ and $V_{s2}(t)$ for $0 \leqq t \leqq 7t_d$.



（背面仍有題目，請繼續作答）

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Problem 7: (20 Points)

A lossless transmission line of $Z_0 = 200\,\Omega$ has an unknown load impedance Z_L and a standing wave ratio of 5. The first voltage minimum is 4 cm from the load, and the minima are 20 cm apart. We wish to match the line by placing a short-circuited stub in parallel with the load and a second stub 10 cm from the load. Find the required stub lengths. (Hint: 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.)