UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE & ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION DECEMBER 2013

TITLE OF PAPER:	**ELECTROMAGNETIC FIELDS II**
COURSE CODE:	**EE441**
TIME ALLOWED:	**THREE** HOURS

INSTRUCTIONS:

1. Answer any **four (4) questions**
2. Each question carries 25 marks.
3. Marks for different sections are shown in the right-hand margin.

This paper has 3 pages including this page.

DO NOT OPEN THE PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.

Question 1

Use a shorted stub to match the load impedance $Z_L = 60 + j45\Omega$ to a 75 Ω transmission line. (A smith chart is attached) (25 marks)

Question 2

Use the Smith chart to determine the input impedance of the two line configuration shown in Figure 2. Note that the characteristic impedance of line 1 is a 100 Ω and that of line 2 is 50 Ω. (25 marks)

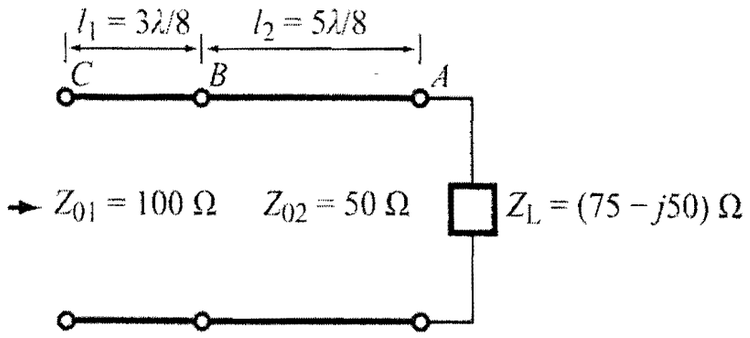


Figure 2

Question 3

The electric field of a uniform plane wave propagating in free space is given by

$$\tilde{E} = (\hat{x} + j2\hat{y})15e^{-j\frac{\pi z}{6}}$$

Determine

a) the magnetic field $\tilde{H}$, **and**
b) the direction of the electric field intensity at z=0 plane at t= 0.5 and 10 ns.

(25 marks)

Question 4

The magnetic-field phasor of a uniform plane wave traveling downward in the direction $\hat{z}$ in sea water is given by

$$\hat{\mathbf{H}} = \hat{\mathbf{x}} 10 e^{-0.2z} e^{-j0.2z}$$

If $\sigma = 4$ S/m and $z = 0$ is the water surface

Determine:

a) the expression for intrinsic impedance η_c, (6 marks)

b) the expression for the average power density S_{av}, (8marks)

c) the attenuation rate, (3marks)

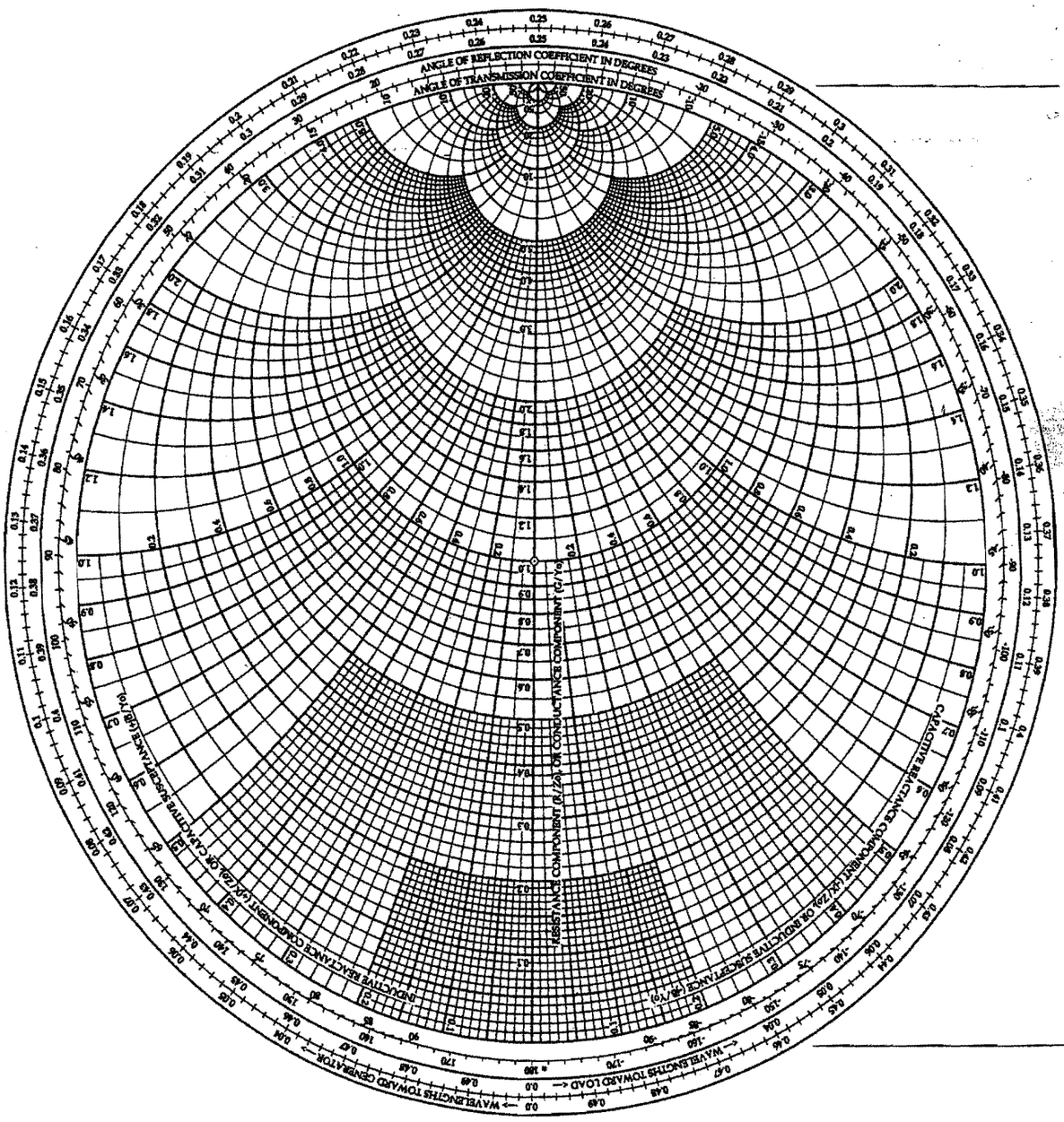
d) the depth at which the power density has been reduced by 40 dB., and (3 marks)

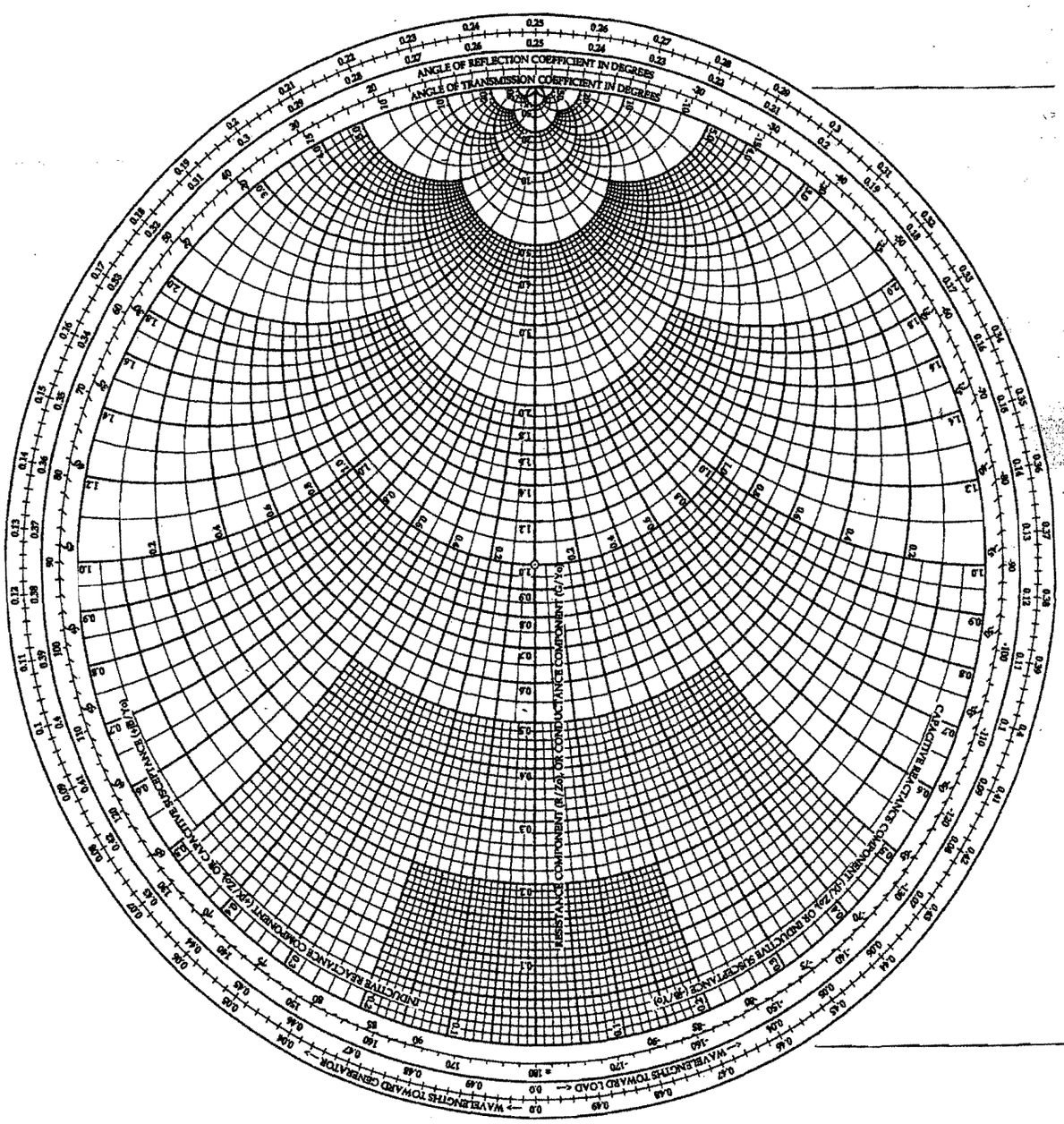
e) the expression for H(z,t). (5 marks)

Question 5

a) A coil consists of 100 turns of wire wrapped around a square frame of sides 0.4m. The coil has its left hand corner placed on the origin with each of its sides parallel to the x- or y axis. Determine the induced emf across the open-circuited ends of the coil if the magnetic field is given by $B = \hat{z} \cos x \sin 2y \cos 10^3 t$ (T). (13 marks)

b) Write down, in both differential and integral forms, Maxwell's equations for the following laws Gauss's laws, Faraday's law and Ampere's law . (12 marks)


ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
WAVELENGTHS TOWARD LOAD
NORMALIZED CONDUCTANCE COMPONENT (G/Yo)
NORMALIZED SUSCEPTANCE (jB/Yo)
INDUCTIVE REACTANCE COMPONENT (jX/Zo) OR INDUCTIVE SUSCEPTANCE (jB/Yo)
CAPACITIVE REACTANCE COMPONENT (jX/Zo) OR CAPACITIVE SUSCEPTANCE (jB/Yo)


ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES
RESISTANCE COMPONENT (R/Zo) OR CONDUCTANCE COMPONENT (G/Yo)
REACTANCE COMPONENT (jX/Zo) OR SUSCEPTANCE COMPONENT (jB/Yo)
CAPACITIVE REACTANCE COMPONENT (-jX/Zo) OR CAPACITIVE SUSCEPTANCE (-jB/Yo)
INDUCTIVE REACTANCE COMPONENT (+jX/Zo) OR INDUCTIVE SUSCEPTANCE (+jB/Yo)
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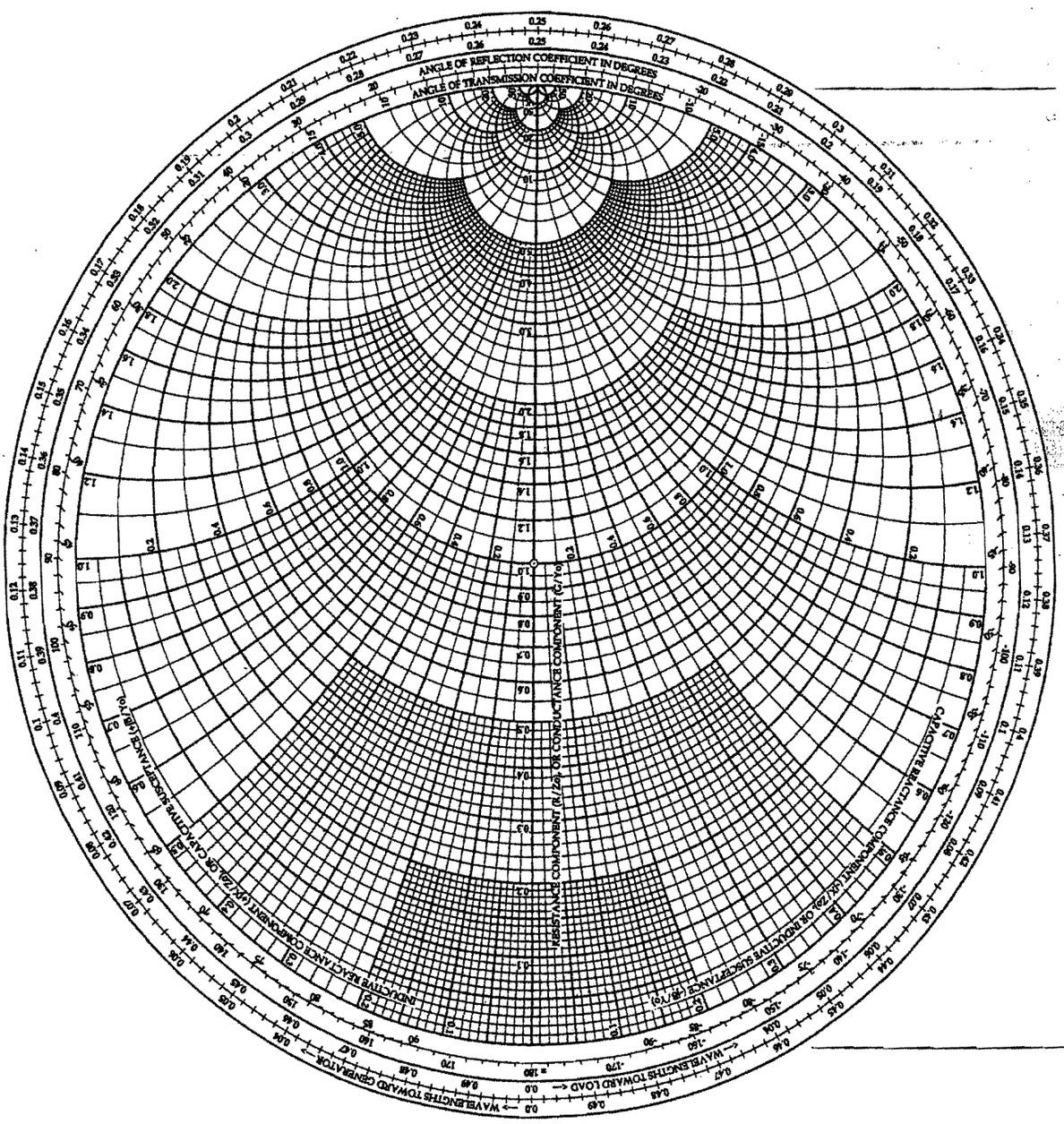
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